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A MONTHLY JOURNAL FOR THE INFORMATION OF THOSE INTERESTED
IN THE PURITY OF FOOD AND DRUGS, AND IN GENERAL
ANALYTICAL AND MICROSCOPICAL RESEARCH.

EDITED BY

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INSTRUCTIONS FOR WATER ANALYSIS.

FACTORS FACILITATING CALCULATIONS.

Substance determined.	Water taken.	Volume or Weight obtained.	Factor to get grs. per gall.	Decimal place to which result to be reported.
Chloride	100 c.c.	Silver Sol. c.c.	0·7 = Chlorine.	Second.
„	1400 grains.	Silver Sol. grains.	0·05 = Chlorine.	
Nitric Acid, Crum's Process	250 c.c.	N_2O_5 c.c.	0·175 Nitrogen.	Second.
„ „ „ „	3500 grains.	N_2O_5 c.c.	0·193 Nitrogen.	
„ „ Copper Zinc..	100 c.c.	NH_3 grammes.	576·45 Nitrogen.	
„ „ or Aluminum	50 c.c.	NH_3 grammes.	1152·9 Nitrogen.	
„ „ „ „	1-40th gall.	NH_3 grains.	32·94 Nitrogen.	
„ „ „ „	1-70th gall.	NH_3 grains.	57·64 Nitrogen.	
Free and Albuminoid Ammonia......	500 c.c.	NH_4 Cl. Sol. c.c.	0·0014 NH_3	Fourth.
	7000 grains.	NH_4 Cl. Sol. grains.	0 0001 NH_3	
Oxygen absorbed	250 c.c.	10 c.c. Permang. used.	0·28 $(1-\frac{B}{A})$.	Third.
„ „	250 c.c.	15 c.c. Permang. used.	0·28 $(1\ 5-\frac{B}{A})$.	
„ „	250 c.c.	20 c.c. Permang. used.	0·28 $(2-\frac{B}{A})$.	
„ „	3500 grains.	100 grains used.	0·2 $(1-\frac{B}{A})$.	
„ „	3500 grains.	150 grains used.	0·2 $(1{\cdot}5-\frac{B}{A})$.	
„ „	3500 grains.	200 grains used.	0·2 $(2-\frac{B}{A})$.	
Total Solids	250 c.c.	Grammes.	280 Total solids.	First.
„ „	3500 grains.	Grains.	20 Total solids.	

* A = c.c. or Grains of Hyposulphite solution corresponding to 10 c.c or 100 grains Permanganate.
B = „ „ „ „ „ used after 15 minutes or 4 hours action.

INSTRUCTIONS TO BINDER.—Bind this opposite page 138.

THE ANALYST
JANUARY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

THE ANNUAL MEETING of the Society will be held at Burlington House on Wednesday, the 19th inst. The Annual Dinner will take place the same evening. The customary circular, with particulars, will be sent to Members as usual.

NOTE ON THE METHOD OF CALCULATING THE QUANTITY OF ADDED WATER IN DILUTED SPIRITS.

By A. ASHBY, M.B., F.R.C.S.

THE excellent alcohol tables compiled by Mr. Hehner, and by Dr. Stevenson, give us a ready way of calculating the exact quantity of water which must be added to spirit of any known strength in order to reduce it to any other, found or wished for, by using, in conjunction with them, the formulæ I am about to propose. The analyst can thus readily state the amount of water which has been added to spirit of the lowest strength allowed by the Sale of Food and Drugs' Act Amendment Act in any adulterated sample which may come under his notice. whilst the spirit merchant can as easily calculate how much water he must mix with a spirit of any known strength in order to reduce it to any other he may desire.

Let us presume that we have an adulterated sample of gin 45 under proof, and that we want to state how much water has been added to gin of the limited strength of 35 u.p. On referring to the tables it is seen that spirit of the latter strength contains 37·14 per cent. by volume of alcohol; consequently it has 62·86 per cent. of water by volume.

Now let us add an unknown quantity of water to this spirit, which may be represented by X. The volume of the diluted spirit will be 100 + X; and the percentage of alcohol by volume in it will be—(100 + X) : 100 : : alcohol by vol. per cent. at 35 u.p. : alcohol by vol. per cent. in diluted spirit.

The latter is the strength of the spirit found by analysis, which in gin 45 u.p. is 31·4. Then—

$$(100 + \mathrm{X}) \times \text{alcohol by vol. per cent. found} = \text{alcohol by vol. per cent. at 35 u.p.} \times 100;$$

$$\text{and } \mathrm{X} = \frac{\text{Alcohol by vol. per cent. at 35 u.p.} \times 100.}{\text{Alcohol by vol. per cent. found}} - 100;$$

and in the example taken—

$$\mathrm{X} = \frac{37{\cdot}14 \times 100}{31{\cdot}4} - 100 = 18{\cdot}28.$$

So that in the adulterated sample 18·28 parts by measure of water have been added to 100 parts by measure of gin of the lowest strength allowed by law.

In the case of brandy, whiskey, or rum, it will be necessary to use the following formula—

$$X = \frac{\text{Alcohol by vol. per cent. at 25 u.p.} \times 100}{\text{Alcohol by vol. per cent. found}} - 100,$$

since 25 under proof is the limit of reduction assigned by the Act to those spirits.

Similarly, by the use of the following formulæ, and the alcohol tables already alluded to, the spirit merchant can ascertain how to reduce a spirit from any known strength to any other he may desire. Thus:—

$$X = \frac{\text{Alcohol by vol. per cent. at present strength} \times 100}{\text{Alcohol by vol. per cent. at desired strength}} - 100.$$

Suppose, for example, that it is desired to reduce brandy from 1 o.p. to 12 u.p.; then on referring to the tables, and using the above formulæ, we shall have—

$$X = \frac{57{\cdot}64 \times 100}{50{\cdot}21} - 100 = 14{\cdot}79.$$

So that to 100 parts of brandy at 1 o.p. 14·79 parts of water must be added in order to reduce it to 12 u.p.

By substituting the percentage of alcohol by weight for that by volume in the formulæ, the relative proportions by weight of spirit and water can be ascertained if desired.

I am not aware whether these formulæ have been proposed before, but, at any rate, the use of them will demonstrate one of the numerous advantages to be derived from the complete alcohol tables by spirit merchants as well as by chemists.

A NEW METHOD FOR THE EXAMINATION OF COFFEE.

By F. M. Rimmington, F.C.S., F.I.C.

I think it will be generally admitted that the methods in use for estimating the degree of adulteration in coffee are far from satisfactory as regards definiteness and certainty, and that something more approaching to chemical accuracy is very desirable. Little has been done in this direction since the days of the *Lancet* Sanitary Commission.

It may not be generally known to analysts that chicory, dandelion and, probably, some other substances that are used for mixing with coffee, are readily deprived of colour by a weak solution of chloride of lime (hypochlorite), and that this agent has very little action on coffee. When this method is adopted, a portion of the coffee should be gently boiled a short time in water, with a little carbonate of soda, so as to remove as much extractive as possible; after subsidence the liquor should be poured off, and the residuum washed with distilled water. When this has been done sufficiently, a weak solution of the hypochlorite is to be added, and allowed to remain, with occasional stirring, until decolouration has taken place, which will probably be in two or three hours. The coffee will then form a dark stratum at the bottom of the glass, and the chicory, a light, almost white stratum, floating above it, and showing a clear and sharp line of separation. The chicory after this operation is in a fine condition for microscopical examination, and both the upper and lower strata of the deposit can be examined for other substances. Although the lower stratum may be dark coloured, and have the appearance of coffee, other substances may be present, and should be looked for.

I have recently met with a substance that is entirely new to me as a coffee substitute that is not affected by this treatment.

NOTE ON BUTTERINE.

By Arthur Angell, F.I.C., F.C.S.

Manufacturers have now succeeded in mixing foreign fats with butter. A large quantity of a compound called "Creamy Butterine" has recently been placed upon the market. It is a palatable article, has all the appearance and odour of a butter, and is therefore very different from the "butterines" and "oleomargarines" hitherto produced. It yields 92 per cent. of insoluble fatty acids, and under the micro-polariscope shows well-defined stellate crystals, thereby proving that some part of the compound has been fused. I may here mention that genuine butters made from scalded cream are crystalline in structure.

ADULTERATION IN AMERICA.

The following is the Report of the Committee of Award in the recent Competition instituted by the American National Board of Trade:—

New York, *Oct. 27th, 1880.*

Frederick Fraley, Esq., *President National Board of Trade.*

Sir,

The Committee appointed by the National Board of Trade for the purpose of awarding prizes for the best Act or Acts, accompanied by an Essay, designed to prevent injurious adulteration, and to regulate the sale of food without imposing unnecessary burdens upon commerce, have the honour to report as follows:

In accordance with the resolutions under which the Committee was constituted, we have carefully examined the papers submitted in this Competition, and from these have selected as the three most meritorious Essays, with the accompanying Acts, numbering them consecutively in the order of merit as follows:

No. 1. The Essay and Acts having the motto, "*Æquo Animo.*"

No. 2. The Essay and Acts having the motto, "*Sic utere tuo ut alienum non laedas.*"

No. 3. The Essay and Acts having the motto, "*Overcome Evil with Good.*"

Upon opening the sealed envelopes, having corresponding mottoes, it is found that the authors of these Essays are as follows, viz.:

No. 1. Motto "*Æqua Animo,*" G. W. Wigner, F.C.S., London.

No. 2. Motto "*Sic utere tuo ut alienum non laedas,*" Vernon M. Davis, New York City, N.Y.

No. 3. Motto "*Overcome Evil with Good,*" William H. Newell, M.D., Jersey City Heights, New Jersey.

In addition to these Essays, we recommend the printing of the Essay having the motto "*Cardinal Cajetan,*" whose author is O. W. Wight, M.D., Health Officer, Milwaukee, Wisconsin; and the remarks submitted under the motto "*Work and Wait,*" by Albert B. Prescott, Ann Arbor, Michigan.

In connection with this award, the following remarks are respectfully submitted:

1. In view of the statements which for the last two or three years have from time to time been made with regard to the prevalence in this country of adulterations of food which are dangerous to health and life, and which have created so much agitation in the public mind, as to induce the National Board of Trade to establish this competition, it is

very gratifying to find that none of the essayists produce any definite or satisfactory evidence as to the widespread existence of such dangerous adulterations in this country.

The absence of such evidence, in addition to the results recently obtained by several expert chemists in extensive series of analyses of the usual articles of food in this country, which results have been made known to the committee, fully warrants us in declaring that none of our staple articles of food or drink are so commonly adulterated as to be dangerous to health or life. Such dangerous adulterations appear to be mainly in the form of poisonous colours or colouring matters, as, for instance, in confectionery, and even these are rare.

2. The question of the adulteration of food, with perhaps the exception of milk, should therefore be considered not so much from a sanitary standpoint as from that of commercial interests; as being of the nature of a fraud, in aiding the sale of articles which are not what they are represented to be. The main objects of legislation upon this subject should be to prevent deception, to furnish to the public authoritative information, and to nullify the operations of ignorant and sensational alarmists, who damage the business interests of the country quite as much as do the evils of which they complain.

3. We are of the opinion that there is much more danger to health and life in this country from adulterated drugs, than there is from adulterated food, and that any legislation which is to deal with the one should also deal with the other.

4. To indicate the legislation upon the adulteration of food and drugs, which will protect health and prevent fraud, and at the same time not impose unnecessary burdens upon trade is a matter of very great difficulty, as the result of this competition clearly shows, for we do not consider any of the Acts proposed to be satisfactory. In this matter it is much better at first to do too little than too much, and the first steps in such legislation should be tentative and educational in character.

5. While it is highly desirable that the general principles of legislation on this subject should be the same in all States, we do not think it possible to secure by State laws absolute uniformity in the details in all parts of this country, and it would therefore be unwise to make the attempt.

6. We do not think that any law upon the adulteration of food and drugs can be made efficient without a properly constituted health authority to supervise its execution. The questions involved are in a high degree technical, and require special training in those charged with administering the law. At the same time we think that the existence of such health authorities should be taken for granted in the Acts and that these should not attempt to create them.

We believe that every State should have a Board of Health, but that such Boards should be created by independent legislation.

7. We think it unadvisable that the law should attempt to define in detail as to what an adulteration is. A very considerable amount of discretion should be left to the Board of Health in this respect, limiting it only in the direction of possible over-rigidity. Many well recognized articles of commerce, although harmless and even useful, may be said to be adulterated, and it should be left to the discretion of the Board to exempt any article from the penalties imposed in the Act.

8. Care should be taken not to make the penalties excessive. It should be remembered that mere exposure of fraudulent practices, if effectually and persistently made, is in itself

a penalty, and as a rule public opinion may be trusted to make such practices unprofitable if measures be taken to make this opinion a correct one, which we think should be the great object of the law proposed.

Under no circumstances should fees or moieties to informers be allowed.

9. We think that both State and National laws upon this subject are desirable. The State law should deal with the subject in the individual State. The National law should deal with adulterated articles coming from foreign countries, or passing from one State into another, and also with adulterations in the Territories, the District of Columbia, and in all places under the special jurisdiction of the United States. It is, of course, in the highest degree desirable that the State and United States legislation on this subject should not be discordant.

The educational feature should be even more prominent in the National than in the State law, while the punitive feature should, if anything, be less severe. As the State laws will vary somewhat in this last respect, it follows that the penalties in the United States law should be at a minimum.

10. The Committee will endeavour to prepare and to place in the hands of the President of the National Board of Trade as soon as possible drafts of Acts, prepared in accordance with the general principles contained in this report.

All of which is respectfully submitted.

(*Signed*) JOHN S. BILLINGS,
C. WILLIAMSON,
C. F. CHANDLER,
A. H. HARDY,
Committee of Award.

The Definition of an Adulterated Article, and the Principal Clauses of the Draft Act proposed in the Essay by Mr. WIGNER, are as follows:—

An Article shall be deemed to be Adulterated within the meaning of this Act.

A.—*IN THE CASE OF DRUGS.*

1. If, when sold under or by a name recognised in the U.S. Pharmacopœia, it differs from the standard of strength, quality, or purity, laid down therein.

2. If, when sold under or by a name not recognised in the U.S. Pharmacopœia, but which is found in some other Pharmacopœia, or other standard work on *Materia Medica*, it differs materially from the standard of strength, quality, or purity laid down in such work.

3. If its strength, or purity, fall below the professed standard under which it is sold.

B.—*IN THE CASE OF FOOD OR DRINK.*

1. If any substance, or any substances, has, or have been mixed with it, so as to reduce, or lower, or injuriously affect its quality, strength, purity, or true value.

2. If any inferior or cheaper substance, or substances, have been substituted wholly, or in part, for the article.

3. If any valuable constituent of the article has been wholly or in part abstracted.

4. If it be an imitation of, or be sold under the name of another article.

5. If it consist wholly or in part of a diseased, or decomposed, or putrid, or rotten animal or vegetable substance, whether manufactured or not; or in the case of milk, if it is the produce of a diseased animal.

6. If it be coloured, or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value.

7. If it contain any added poisonous ingredient, or any ingredient which may render such article injurious to the health of a person consuming it.

LIMITS.

The following shall be deemed limits for the respective articles referred to.—

Milk shall contain not less than 90 per cent. by weight of milk solids, not fat, and not less than 2·5 per cent. of butter fat.

Skim milk shall contain not less than 9·0 per cent. by weight of milk solids, not fat.

Butter shall contain not less than 80·0 per cent. of butter fat.

Tea shall not contain more than 8·0 per cent. of mineral matter, calculated on the tea dried at 100° C., of which at least 3·0 per cent. shall be soluble in water, and the tea as sold shall yield at least 30·0 per cent. of extract.

Cocoa shall contain at least 20 per cent. of cocoa fat.

Vinegar shall contain not less than 3·0 per cent. of acetic acid.

It will be seen that in the case of drugs sold under names found in the U.S. Pharmacopœia, this definition allows of no deviation, either by increase or decrease of strength, quality or purity.

As to drugs not called official, it appears desirable to allow some slight variation, because different standard authorities do show slight discrepancies, and therefore, in that case, the words I have used are "differs materially."

AS TO FOOD AND DRINK.

The watering of milk is provided for by Nos. 1 or 2, the skimming of milk by No. 3, which also provides against the sale of partly exhausted coffee or tea. The sale of butterine under the name of butter by No. 4.

Milk from diseased cows, pickles made from rotten vegetables, or rancid or putrid butter are provided for by No. 5, and the refacing of tea or polishing of coffee and pepper, and the case of hams coloured externally with chromate of lead, &c., by No. 6.

The admixture of chicory with coffee, potato starch with arrowroot, damaged flour with sound flour, and other similar adulterations, are provided for by No. 2, and the undue watering of spirits by No. 1 or No. 2; and bad spirits containing large quantities of fusel oil, or beer containing "cocculus indicus," or other injurious constituents by No. 7, which also provides for the presence of lead or poisonous metals in tinned goods.

This definition is purposely drawn in the most stringent form, because all exceptions which should be made in order to prevent the Act from bearing with undue pressure upon honest tradesmen, or from hampering manufacturers, are the better made in the Act itself, and not in the definition.

The definition should meet every possible case of fraud or carelessness, and the Act must provide relief from its stringency wherever that relief is needed.

Appended to the definition, it will be desirable to have the table of limits, which may, perhaps, at a future time be extended with advantage, showing the degree of richness or quality required in certain articles. This should be inserted as a separate schedule to the Act, and power should be given to the State Board of Health, as provided in the draft Act,

to add to, take from, or alter these limits from time to time as may be found desirable, due notice being given to the public of any such alteration.

APPENDIX A.

Proposed Draft of a National Act, by Mr. Wigner.

An Act to Prevent the Adulteration of Food and Drugs, or the Sale of Adulterated Articles of Food or Drugs.

Whereas it is reported that adulterated or spurious articles of food and drugs are manufactured, imported or sold within the United States; and also that damaged or diseased articles of food or drugs are manufactured, imported or sold; and whereas, in order to prevent injury to the public health, or fraud, injury, or prejudice or loss to the purchaser of such articles as those hereinbefore referred to, it is desirable to suppress such practices.

Be it enacted :

For the purpose of this Act the definition of an adulterated article shall be that which is given in Schedule A of this Act, and wherever an adulterated article is herein referred to the phrase shall be interpreted in accordance with that definition.

The term " food " shall include every article used for food or drink by man, except water.

The term " drug " shall include all medicines for internal or external use.

State Boards of Health shall be constituted, which shall consist of at least one analyst, one physician, one barrister, and one retired merchant. No member of these boards shall, while acting as such, be directly or indirectly engaged in the sale of food or drugs.

The first members of such boards shall be appointed by the House of Representatives of each State, and they shall be appointed for three years.

The members of this board shall be remunerated for their services at the rate of ....dollars.

The first duty of each of these boards shall be to appoint a public analyst, or public analysts, and an inspector or inspectors, and to arrange for the payment of their remuneration. The remuneration of public analysts shall consist of an annual salary not exceeding .... dollars, and the sum of........ dollars per sample analyzed. When a public analyst is called to give evidence in any case, he shall receive, in addition, the sum of ....dollars per day and his travelling expenses. The public analyst shall be appointed for a term of not less than three years. The State board may, if they think desirable, provide and furnish a laboratory for him. The remuneration of the inspectors shall consist of a sum not exceeding ....dollars per annum, and the sum of........dollars per day travelling expenses when actually travelling on his business. Every inspector so appointed may appoint a deputy to act for him when desirable, at a salary of ....dollars.

Every public analyst so appointed shall be an analyst who has been in actual practice for two years, and who is skilled and has had practical experience in chemical and microscopical analysis.

Every inspector to be so appointed shall be a man of due experience and discretion, and the choice shall by preference be made from those who have already had experience in other sanitary work.

It shall be the duty of each inspector appointed under this Act, from time to time, to procure samples of every article of food or drink or drugs exposed for sale, or on sale, in any street or shop, or store, or other place, or being delivered to consumers, and to submit these samples to the public analyst for analysis. In purchasing these samples the inspectors shall, as regards the class of goods purchased and the time of purchase, act under the direction of the public analyst, subject to any control by the State boards. The number of such samples shall not, in any district or township, be less than one per annum per thousand of the population.

When an inspector has purchased any sample, he shall divide it into two portions, each of which shall be sealed with an official seal. Should the vendor request it, he shall be at liberty to affix his own seal to each parcel. The inspector shall forthwith transmit one portion of the sample by mail, express, or otherwise to the public analyst, or shall personally deliver it to the public analyst, and shall retain the other sealed portion of the sample until he receives the certificate of the analysis thereof, or in case the sample prove to be an adulterated one, until the case has been heard and decided by the Court.

It shall be competent for any purchaser of any article of food, drink, or drugs, who may suspect the same to be adulterated, to submit the same to the public analyst for analysis, upon payment of a fee of three dollars per sample, but it shall be the duty of the purchasers in such case to sign a declaration stating where and of whom the sample was purchased, and the price paid for it, and the name under which it was sold.

It shall be the duty of the analyst to analyze or examine all samples submitted to him by the inspectors or purchasers as aforesaid, and to report upon them by a certificate, on a form similar to that given in the schedule to this Act.

The said certificate shall be *prima facie* evidence in any Court, so that the attendance of the analyst may be dispensed with. It shall be the analyst's duty to state in this certifiate whether the article is adulterated or not adulterated, according to the meaning of this Act, and if it is so adulterated he shall state, as far as practicable, the nature and percentage of that adulteration, and whether the same would render the article injurious to health, and whether the same is so small in quantity as to render it desirable not to prosecute for a first offence, together with any other observations he may think it desirable to make.

From and after the passing of this Act no person shall, except as hereinafter provided in Section 11, sell or offer or expose for sale, or deliver any adulterated article, either in the streets or in any store or market or shop, or stall, or other place of business, or on a round from house to house, under a penalty for the first offence not exceeding 50 dollars. for the second offence a penalty not exceeding 100 dollars, and for the third and subsequent offences a penalty not exceeding 250 dollars, and in addition to the latter penalty the Court shall, in the case of a third offence, order the publication of the name and address of the vendor, and of the fact of his having been twice or more frequently previously convicted in the local or district papers at his own cost. But if the certificate of the public analyst shall state that the sample has been so adulterated as to be injurious to health, the court is hereby empowered to increase the penalty imposed to any sum not exceeding five times the amount of the maximum penalty laid down for first, second, and third offence.

The fines and other payments shall be applied towards the expenses incurred under this Act.

Notwithstanding the preceding sections of this Act, it shall be lawful to sell any admixtures of substances or substitutes for substances, such as are already recognized as ordinary food products, provided that the same are not injurious to health, and that the vendor by himself or his servants makes a declaration of admixture to the purchaser at the time of, or prior to the delivery of the article, either by means of a label affixed to the sample stating distinctly that the substance is a mixture, or by a verbal declaration that the article is sold as a mixture.

The limits attached to the definitions, and forming Schedule B of this Act shall, in the first instance, be taken as the limits of strength or purity of the various articles therein enumerated, but it shall be competent for the State Board of Health from time to time to revise the figures therein contained, or to add other limits to them.

Every person selling, or offering or exposing any article of food or drugs for sale, or delivering any article to purchasers, shall be bound to serve or supply any inspector appointed under this Act who shall apply to him for that purpose, and on his tendering the value of the same, with a sample sufficient for the purpose of analysis of any article which is included in this Act, and which is in the possession of the person selling, under a penalty not exceeding 50 dollars for a first offence, and 100 dollars for a second and subsequent offences.

Each analyst shall submit a quarterly report to the State Board of Health, giving the results of all the analyses made by him during the preceding quarter, and these reports shall be published either quarterly or annually.

The analysts appointed by the various States shall from time to time meet and decide upon the most suitable and efficient processes for the various analyses to be made. These processes shall be submitted to the State Board of Health, and after receiving their sanction they shall have the force of a Schedule to this Act, until again amended by the analysts so assembled, and the amendment confirmed by the State Board.

No public analyst shall give a certificate of the adulteration of any article of food or drugs, unless he has worked according to one of these processes.

The Second Essay, by Mr. V. M. Davis,

Contains no Definition of Adulteration, but the Principal Clauses of the Proposed Act are as under:—

Section I.—The term food and drink shall include every article used by man as food and drink, except drugs and water.

Section II.—The term adulterated food and drink shall include any article of food and drink to which there has been added any foreign substance or substances, whose presence is not acknowledged in the name under which said articles of food and drink are sold, whereby loss to the purchaser, deception of the purchaser, or concealment from the purchaser of the true quality of the article results.

Section III.—No person shall manufacture, or have for sale, offer for sale, or sell within the State, any article of unwholesome, deleterious or adulterated food or drink, under a penalty of one hundred dollars for the first offence and three hundred dollars and imprisonment for one month for each succeeding offence.

Section IV.—No person shall manufacture, or have for sale, offer for sale, or sell within the State, any article of food or drink which has been colored, stained, coated, faced, or otherwise treated in such a way as to conceal from the purchaser its real value or quality: unless such staining, coloring, coating, facing, or other treatment is acknowledged in the name under which the said article of food or drink is sold;—under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

Section V.—Any person or persons who shall color or stain, or cause to be colored or stained, any article of confectionery with chrome yellow or chromate of lead, Prussian blue, arsenite of copper, red oxide of lead, or other deleterious or injurious substances; and any person or persons who shall have for sale, offer for sale, or sell within the State, any article of confectionery so colored or stained, shall be fined two hundred dollars for the first offence, and four hundred dollars and imprisonment for two months for the second and each succeeding offence; except it shall be that those articles of confectionery, so colored or stained, were so colored or stained for purposes other than sale or consumption.

Section VI.—No person shall abstract or remove, either wholly or in part, any ingredient from any article of food or drink; nor shall any person have for sale, offer for sale, or sell within the State as the pure article, any article of food or drink from which any ingredient has been so abstracted or removed; except such abstraction or removal be for purposes of purification, or of otherwise improving the quality or condition of said article, under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

Section VII.—No person shall have for sale, offer for sale, or sell within the State, any adulterated milk, or milk to which water or any foreign substance or substances has been added; nor shall any person have for sale, offer for sale, or sell as pure milk, milk from which the cream has been removed, either wholly or in part, under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

Section VIII.—No person shall have for sale, offer for sale, or sell within the State, as pure butter, any article made either wholly or in part of animal or other foreign fats, under a penalty of one hundred dollars for the first offence, and three hundred dollars and imprisonment for one month for each succeeding offence.

Section IX.—Ignorance on the part of any person or persons having for sale, offering for sale, or selling, any article of food and drink, of the true quality or character of the food or drink so held for sale, offered for sale, or sold, shall not constitute a defence, or be received as such in any action brought for the violation of any of the foregoing provisions, or all of them.

Section X.—The names and addresses of any person or persons who shall be convicted of violating any of the sections of this Act, shall be printed once for each offence, together with the particulars of the offence, in two of the prominent newspapers published in the county where the offence was committed.

SAFETY CHEQUES.

Mr. A. A. Nesbit, F.C.S., has recently patented an invention which has for its object the prevention of forgery in connection with the alteration of cheques. The method which Mr. Nesbit proposes is, we believe, a step in the right direction, and will probably, if adopted, diminish to a considerable extent the chances of forgery. The invention consists in using paper coloured or stained with an acid or alkaline dye, which dye is sensible to the action of either acid or alkali. The paper so stained is printed with a colourless acid or alkaline ink, so that the effect produced is an acid or alkaline writing upon a ground coloured with a sensible dye having a different reaction; so that when an attempt is made to alter the printing the effect produced is that the difference between the colour of the printing and that of the ground is destroyed and the printed inscription rendered illegible.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

LARD ADULTERATION.

To the Editor of "The Analyst."

Sir,—Has any investigation been made with regard to the adulteration of lard? I find that all lard sold by grocers is of a very inferior quality when compared with the pure article. My attention was first drawn to the matter through pastry being hard and tough when shop lard was used. On comparison of melting points I find the following:—

Pure home-rendered lard	.. ..	112° F.
Chemists' prepared lard	.. ..	113°
Grocers'—1	.. ..	106°·5
,, 2	.. ..	96° (American)
,, 3	.. ..	95°
,, 4	.. ..	103°
,, 5	.. ..	102°

What is the probable adulterant? Mangosteen oil? No other animal fat, except butter, has so low a melting point.

The selling price of these lards is 7d. and 8d. per lb.; chemists' is 11d., and rendering one's own lard costs 10½d., the pig's leaf being 8d. per lb. at the butcher's. To sell lard at 7d., therefore leaves a margin on the wrong side for profit.

I am, &c.,

Rugby, *Dec. 4th*, 1880. A. PERCY SMITH.

LAW REPORTS.

Butterine Sold for Butter.—Defendant Cautioned:—

At the Northern Divisional Police Court, Dublin, Edward O'Beirne, of 31, Talbot Street, was summoned for having, on September 18, sold as butter, the substance known as butterine. The certificate of Dr. Cameron, City Analyst, set forth that the stuff in question submitted to him for analysis was a compound of foreign fats, not butter fats. An inspector of nuisances of the Corporation, named Toller, deposed that on the day in question he went into the defendant's premises and asked for a half-pound of 10d. butter. The stuff now in question was sold him. When he announced himself an inspector, the assistant told him that it was butterine he had sold him. The "cool" from which the stuff was taken was not marked butterine, nor did witness observe any butterine labels in the shop. The assistant deposed that before he sold the butter he told the prosecutor it was butterine. It was further deposed that there was a cool of butterine marked as such, but that the label accidentally fell flat. The assistant was positive that he had stated the substance sold was butterine before the inspector said who he was. Mr. O'Donnell said he would not go into the question raised by the conflict of evidence. He would dismiss the summons with a caution, but at the same time he advised the defendant to be a little more careful in future, and to see that the cards are so placed in the shop that they will not fall down.

Another Case.—Defendant Fined:—

In the Southern Division, before Mr. Exham, Michael Kavanagh, of 46, Upper Kevin Street, was summoned for an offence similar to that alleged against Mr. O'Beirne. The evidence was similar. Prosecutor asked for half-a-pound of 10d. butter. The cool from which the butterine was taken was not marked butterine, but in an obscure portion of the shop, as the complainant alleged, there was a card hanging up, marked butterine. Defendant submitted that this label was in a conspicuous position in the shop, and invited inspection of it by Mr. M'Sheehy himself. He said it was by a mere catch he was made liable, when he had a label posted in his shop, and everyone knew that good butter could not be bought for 10d. a lb. Mr. M'Sheehy said that there was indeed a catch in the matter, but it was a catch on the public. Mr. Exham considered the offence proved, and fined the defendant £5.

Another Case.—Wilfully Deceiving the Public:—

James Molloy, of 80, Lower Camden Street, was charged with a similar offence. In this case the prosecutor deposed that one of the cools of butter was marked with a label on which was written butterine, but over the "ine" was placed a smaller card marked 10d., so that the apparent marking on the cool was "butter, 10d." Mr. Exham considered that this proceeding was a wilful deceiving of the public—it was a very bad case, and he would impose a fine of £10.

John Connell, 36, Wexford Street, was summoned for a similar offence. In this case the defendant was fined £5, and announced his intention of appealing. He stated that it was almost his invariable rule to inform those whom he thought were not aware of the nature of butterine, exactly what it was.

Appeal.—Railway Porter not Agent of Consignor.—Consignor not entitled to one portion of sample:—

In the Queen's Bench division, the case of Rouch v. Hall came before the Court as an appeal by the Inspector of Nuisances for the parish of St. Pancras, from a decision of Mr. de Rutzen, the Magistrate of the Marylebone Police Court, on an information laid under the Sale of Food and Drugs' Act of 1875, and the Amendment Act of 1879, against the respondent, a farmer at Coventry, for the adulteration of milk consigned by him to a Mrs. Sims, a milk dealer in London.* It appeared from the case, as stated by the learned Magistrate for the decision of this Court, that the Inspector was at Euston Station on March 18th last, and saw a can containing milk being taken from the van, and which was consigned by the respondent to Mrs. Sims. He accordingly, in pursuance of the provisions of Section 14 of the Act of 1875, demanded and received a sample, which he divided into three portions, one of which he gave to the porter, treating him as the agent of the respondent, and stating at the same time that he intended to have the milk analyzed. The Inspector, however, took no steps to acquaint either the respondent or the consignee with his intention, but finding the milk was adulterated with water, laid his information. On the hearing of the summons, it was dismissed by the Magistrate, who held, in effect, that the railway porter was not the agent of respondent, and that the proceedings adopted by the Inspector were not in compliance with the Act. From this ruling the Inspector now appealed to this Court. Mr. Tickle having argued the case for the appellant, Mr. Justice Field gave judgment. He said the Court were of opinion that the appeal must be allowed. They were clearly of opinion that the railway porter was not the agent of the respondent, within the provisions of the 14th section of the Act of 1875, nor was he bound to accept a third of the sample of the milk, although he would have been liable to a penalty had he refused to supply a sample. The object of the Act was to secure to the public a supply of pure unadulterated milk, and for that purpose it was liable to seizure at the time of its being sold by the seller or his agent, and provided that a third of the small sample should be tendered to him, so that he might be enabled to have an independent analysis to show whether it was adulterated or not. But as milk had to be supplied from the country, and it was found that a hardship was often inflicted on the London seller, to whom adulterated milk was supplied by farmers, it was enacted by the Amendment Act of 1879 (42 and 43 Vic., c. 30) that the Inspector should have the power of seizing the milk at the place of delivery to the consignee. In this case the delivery had not been completed, and although the railway porter could not be held to be the agent of the consignor, the Court was of opinion that by the Amendment Act the Legislature did not intend to extend to the consignor that privilege which was afforded under the previous Act to the seller, namely, that of giving him a third of the sample to enable him to obtain an independent analysis. For these reasons the appeal would be allowed, and the case remitted to the Magistrate for judgment. Mr. Justice Mauisty concurred. Judgment accordingly.

Dublin Milk.—Interesting Proceedings.—Certificate of Somerset House Chemists:—

At the Northern Divisional Police Court, on the 20th November, before Mr. O'Donnell, William Fynch, a dairyman of Upper Dorset Street, in this city, appeared in answer to two summonses charging him with selling milk adulterated with water. The case had already been before the Court. The evidence of Mr. Ballantyne, Inspector of Food and Drugs under the Corporation, was to the effect that, on September 16th, he purchased from the Defendant a pennyworth of milk. He made the usual declaration, and offered to give him a third part, but he declined to accept it. Dr. Cameron, on analysis, had certified that it contained 20 per cent. of water. Mr. O'Donnell: The defendant, then, not satisfied with Dr. Cameron's certificate, demanded a reference to Somerset House. and a special case was made upon what the ingredients should be. Mr. M'Sheehy (Law Agent to the Corporation): And it was further decided that the same cows should be milked in the presence of the Corporation Officer and a person on behalf of the accused, and that the milk then obtained should be sent to Somerset House for analysis and report, and that the report should come back to your Worship. Mr. O'Donnell: And then the result should be, if the second milk, taken in the presence of the officer, was certified from Somerset House to be of the same quality as the impeached milk, the defendant should be acquitted. Dr. Cameron:

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* *See* THE ANALYST, vol. v., p. 108.

Acquitted, no matter how it should be. Mr. Swift, solicitor for defendant: But there was this exception, that the cows should be the same as those which gave the milk analysed by Dr. Cameron. Mr. O'Donnell: I don't care. If there was any shifting, it was your client's fault. You are bound by your own acts. Mr. M'Sheehy: I understand the certificate has been received from Somerset House, but I have not seen it. Mr. Beard then stated that the questions sent to Somerset House with the second sample of milk were:—"Are the two samples of milk (Nos. 1 and 2) identical? If No. 2 is richer than No. 1, what proportion of water should be added to No. 2 to reduce the amount of solid matters in it to that in No. 1? The certificate stated the result of the analysis was—

	No. 1.	No. 2.
Per cent. of solids (not fat)..	6·44	8·90
Per cent. of solid (fat)	2·33	4·08
Per cent. of water	91·23	87·02
	100·00	100·00

"From these results it will be seen that No. 2 is much richer than No. 1 milk. After making allowances from natural loss arising from decomposition of No. 1 milk through keeping (No. 1 being fifty-three days' and No. 2 ten days' old), we are of opinion that not less than 22 per cent. of water would require to be added to reduce the solids not fat in No. 2 to the amount found in No. 1 milk." The defendant said he had sold the cow which gave the first milk, before the officer went the second time. Dr. Cameron said it was a fact, when they went to the man's house he said he had sold one cow; but three of the original cows were there. These three were milked, and all the milk mixed together. Defendant had given every facility for the proper milking of the cows. Mr. O'Donnell said there was no doubt he might be an honest man as things were going now, but he would have to pay the costs of this additional proceeding. Mr. M'Sheehy: Dr. Cameron stated he would not ask the defendant to pay the costs of the additional proceeding, in any event. Mr. O'Donnell said the defendant would have to pay the costs of the analysis by Somerset House, and he accordingly fined him £2 and £1 1s. costs. In a second case against the same defendant, the milk was purchased by Mr. David Toller, inspector, on Oct. 11th, and Dr. Cameron certified to 30 per cent. of water being in it. Defendant, who was fined £4, said he should appeal in both cases.

NOTES OF THE MONTH.

If things go as they at present appear to tend, we shall shortly have a very considerable enlightening as to the important subject of Water Analysis and standards of purity. That there is great need of seriously attacking this subject is shown by the report of Col. Bolton, the Government Water Examiner, who again this month urges the fixing of a definite standard. The Council of the Society of Public Analysts have had the matter under careful consideration for some time, and hope, by the co-operation of the members throughout the country, to be able to shortly put their scheme in force. We are glad to be able to state that nearly all the Public Analysts in England have agreed to join in working out the idea evolved by the Water Committee, consisting of Messrs. Muter, Dupré, Blyth, Hehner, Dyer, Heisch, and Wigner, and to send in regular monthly analyses of the chief water supply of their districts for publication in our columns, and communication to the Government. Of course it would be at the moment impracticable that County Analysts should supply analyses of any but the county town supply; but we trust that soon the various local authorities will be advised by their medical officers to instruct the analyst to examine and make a return of the quality of the water supply of all the various smaller towns. In this way our Society hopes to obtain reliable information on the special mineral characters of the waters of each county, and so get at the real value of several at present disputed points, notably that of the signification of the presence of nitrates in the water of any particular district. We hope to publish the first table of these analyses in our next number.

The great difficulties to be solved by the committee were, doubtless, which of the rival processes was to be adopted in dealing with organic impurity, and how the results were to be calculated; and we must confess that they appear to have solved the difficulty in a thoroughly practical manner, by adopting for the former a combination of the "albumenoid ammonia" and "oxygen consumed" processes, and for the latter parts in 70,000 (*i.e.*, grains per gallon). Looking to the fact that none of the processes actually profess to estimate the organic matter itself, it was of importance to select the most rapid and reliable for such systematic analyses. Dr. Frankland's process, although very beautiful from a scientific point of view, involves the use of fragile apparatus, requiring very peculiar care in manipulation. If, therefore, the committee had adopted it, we should have had country analysts every now and then completely stopped for, perhaps, weeks, while their apparatus went up to London to be repaired. The system, moreover, takes time, wants special practice in its use, and is not suited for accurate work in a general laboratory. On the other hand, both the processes adopted may be finished in [illegible] and a-half hours, and we have the results of the one to check the other. It is true that other things besides absolutely dangerous organic matter m[illegible], given such extensive reduction, coupled with high albuminoid [illegible] most scientific advocate of "organic carbon" would think tw[illegible]. Then again, as to the mode of reporting results, it is to [illegible] statistics are to be placed before non-scientific persons, [illegible] never become acclimatised in Great Britain. [illegible] but they readily comprehend grains per gallon, and [illegible] a quart a day of such a water they would take so many [illegible]. This appeals to all, and is, therefore, the natural way to state the results [illegible]. It is, moreover, equally suitable for analysts who use "grains" and those who [illegible] "grammes."

It is in contemplation to continue the work, by shortly issuing definite standards of valuation, on a similar principle to that proposed some years ago in a paper on Water Analysis by Mr. Wigner; but, as this question is still under consideration by the Council, we cannot enter into it this month, further than to say that we hope the time is not far distant when the same water sent to every Public Analyst in England will be returned with the same opinion, just like an analysis of milk or butter. A great reduction in zymotic diseases may be confidently looked forward to as the result of this.

The bankers, as well as the general business public, also will be much interested in a recent invention of a member of our Society, for giving them a cheque which cannot be tampered with. In another column will be found an abbreviation of the patent of Mr. Nesbit, whereby, by the use of litmus in printing such documents, the inventor claims to render them absolutely secure from alteration by chemical means. We hope that Mr. Nesbit's invention will be subjected to crucial tests immediately.

A milkman in Dublin being prosecuted, on the Society's standard, for adding 20 per cent. of water, brought forward all the old defences about poor cows, feed, &c., and actually challenged the milking of his cows and submitting the sample to Somerset House side by side with the condemned one. Here is the result, which had better be studied:—

	Fat	Solids not Fat.
No. 1. Inspector's sample (53 days' old)	2·33	6·14
No. 2. Cow's—milked (10 days' old)	4·08	8·90

And the Somerset House Chemists certify that "from these results it will be seen that No. 2 is much richer than No. 1 milk. After making allowances for natural loss arising from decomposition of No. 1 milk through keeping (No. 1 being 53 days' and No. 2 10 days' old), we are of opinion that not less than 22 per cent. of water would require to be added to reduce the solids not fat in No. 2 to the amount found in No. 1 milk."

The above analysis, by the way, shows how carefully the chemists at Somerset House now work, and that they have studied the subject of milk; so that their results are in excellent accordance with those of the members of our Society.

ADULTERATION OF SAFFRON.—Saffron is sophisticated with [illegible] safflower, *Crocus vernus*, [illegible] and heavy spar. If *Calendula* flowers [illegible] a few flowers and rub them [illegible] a fine, rich yellow, but the Calendula a violet reddish hue. It may also be easily detected by soaking the sample in distilled water. Real saffron retains its colour for hours, whilst Calendula looses its tint in a short time.—*Chemists' Journal.*

SOAPSTONE.—A NEW ADULTERATION.—A firm in Cincinnati, known as the Facing Company, are producing a powdered soapstone, which is being used by farmers and butter merchants for adulterating purposes. The article is a fine powder with neither colour nor taste, and costs about £5 a ton. A tub of butter will bear adulteration to the extent of seven or eight pounds of soapstone, and yet defy detection, as, though it increases the weight, it does not very materially affect the bulk. The merchant who made the discovery states that he was shown into a room where the adulteration process was going on, and when he tasted the pure butter and the adulterated article he could not detect the difference. The cost of the soapstone enables packers to mix it with butter at a trifling cost, whilst it gives them an additional profit of upwards of 14 per cent. It is stated that the powder is being secretly supplied to dairymen and farmers, and that the adulteration is now going on in churning-rooms. It should be said that the butter dealers are furiously indignant at being charged with adulterating their goods with soapstone. All deny the allegation, and the firm against which the strongest suspicion has been entertained offers to pay five dollars an ounce for all soapstone found in its butter.—*Provisioner.*

At a late extraordinary meeting of the Vestry of St. Marylebone, Dr. A. Wynter Blyth was appointed Medical Officer of Health and Public Analyst for the parish, *vice* Dr. Whitmore, deceased.

At a recent meeting of the Musselburgh Town Council, Mr. J. Falconer King, Edinburgh City Analyst, was appointed Public Analyst for the burgh.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price
1568	W. A. Barlow	Manufacture or Extraction of Tannin	6d.
1580	E. P. Alexander	Dynamo-Electric Machines	6d.
1632	W. R. Smith and J. F. Pollock	Manufacture of Artificial Fuel	8d.
1700	T. G. Young	Production of Ammonia	2d.
1704	H. J. Haddon	Electric Lamps	6d.
1705	L. A. Davies	Liquid Compound for Electro Decomposition of Aluminium	2d.
1755	H. P. Scott, and T. D. Donaldson	Anti-fouling Composition for Coating Ships' Bottoms ..	4d.
1764	R. and M. Theiler	Telephone Apparatus	2d.
1767	M. L. Emmanuel	Manufacturing Oleomargarine	2d.
1771	J. H. Johnson..	Dyeing, &c.	1d.
1788	F. Brady	Treatment of certain Ferruginous Salts obtained from Iron and Steel for Coating with other Metals	4d.
1794	J. Broad	Treating Oils and Wax from Shale, Peat, &c.	6d.
1814	W. C. Locke	Amylaceous Compounds	4d.
1826	J. E. Gordon	Apparatus for producing Electric Light	6d.
1840	W. R. Lake	Production of Electric Light	6d.
1852	J. Lefranc	Manufacture of Chemical or Artificial Coal	2d.
1890	G. T. Glover	Manufacture of Ammonia and Ammoniacal Salts.. ..	2d.
1919	H. H. Lake	Manufacture of Azotic or Nitrogenous Fertilizing Compounds with a Carbonaceous Residuum	4d.
1958	J. H. Johnson	Telephonic Exchange Systems	1s. 8d.
1959	J. Hardman	Production of Anthracene from Gas Tar	2d.
1980	G. Wischin	Distillation of Anthracene from Coal Tar	4d.
2018	W. R. Lake	Manufacture of Gas	2d.
2025	W. Smith	Spirit for Use as a Detergent, Solvent, &c.	2d.
2029	R. C. Menzies	Manufacture of Paper for Cheques	2d.
2089	B. W. Gerland	Treatment of Phosphorites, Coprolites, &c., in preparation of Soluble Phosphate or Phosphoric Acid ..	4d.
2930	J. Imray	Precipitating Solid Constituents of Sewage to Secure their Fertilizing Properties	2d.
2963	Do.	Treatment of Gas Liquor for Production of Ammonium Sulphate	2d.
	Do.	Apparatus for Distilling Ammoniacal Liquor	6d.
	Do.	Recovering Bicarbonate of Ammonia in the Ammonia Process for the Manufacture of Soda	6d.
3785	W. M. Jackson	Carburetting Gas and Air	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Reports on Water and Sewer Air, by Professor W. R. Nichols; Paper by J. Hargreaves on Sulphate of Soda.

THE ANALYST.

FEBRUARY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The Annual Meeting of this Society was held at Burlington House, on Wednesday, the 19th January, Dr. Muter in the chair.

The minutes of the previous meeting were read and confirmed.

The retiring President, Dr. Muter, delivered the following Valedictory Address:—

In accordance with our now time-honoured custom, it becomes my duty to say a few words in the form of a Farewell Address, giving a sketch of the progress of the Society under my Presidency, and of the condition in which I hand it over to my successor, who will be elected to-night. When last year you were pleased to hear from my lips that our Society had held its own in spite of the desertion of some members who were wooing a new love, how much more satisfaction will you not now feel when I tell you that since then we have made an advance in number of nearly ten per cent. Our Society is special and, consequently, exclusive, and can never be numerically large; but we stand to-night a compact band of over 100 Members and 14 Associates, all practical men, actively engaged in the practice of Analytical Chemistry, with the entire absence of amateurs and *dilletanti.* During the year we have gained eleven new Members and one Associate, and we have to-night propositions before us from seven gentlemen desirous of becoming Members, besides a ballot for the election of one new member, and of two gentlemen recommended by the Council for election as Associates.

It is my painful duty to record that the grim tyrant, to whom we all must bow, has been busier in our ranks than heretofore, as we have to regret the death of three members, viz., Messrs. Stoddart, of Bristol; Edger, of Newcastle; and Dr. Proctor, of York; all good men and true, who did their duty in life, and let us hope not without reward. Of their personal merits I would speak more fully were they not sufficiently well known to all of us. Turning now to a more pleasant theme, let me for a moment call your attention to the work done by our Society in furtherance of its great object, namely that of increasing our knowledge of proper processes for the analysis of food and drugs. I find that this goes on steadily increasing, and that during 1880, we have had the large number of 44 original communications either made to us directly or published in our Journal, The Analyst, as against 41 for 1879. Of these we have had five each from our Secretary, Mr. Wigner, and myself, three each from Messrs. Allen, Hehner, and West-Knights, two each from Messrs. Perkin and Smetham, and one each from Drs. Dupré, Wallace, Bartlett, Cameron, Shea, and Messrs. Wynter Blyth, Lyte, Blunt, Dyer, Harvey, and Napier, the remainder being communications printed in The Analyst from gentlemen outside the Society. We have also had published in The Analyst Mr. Wigner's usual able digest of the working of the Sale of Food and Drugs Act, some abstracts by one of our Associates, Mr. De Koningh, and last, but by no means least, Mr. Hehner's truly admirable and complete Alcohol Tables, without which no laboratory can be said to be fully furnished. I think, gentlemen, you will agree with me in saying that our Society could not put in a better claim for recognition as holding the first position in our special branch of chemistry, than is found in these statistics.

Last year our justly respected Vice-President, Dr. Dupré, made a remark to the effect that, when our work became better known among chemists generally we would receive such recognition. These remarks have proved truly prophetic, as I can say, having heard it from more than one source, that this past year has seen a marked advance in the position of our Society in the minds of those scientific chemists whose opinions count for something. We have had to struggle with much openly-declared enmity, and still more secret backbiting, and as an instance, I may mention that one of our own members even had the bad taste to advise a gentlemen not to join "a small society" like ours. The advice, however, fell flat, the gentleman in question joined us, and I notice particularly that our advice-giving member's name is conspicuously absent from the list of those who have helped by their work to show that quantity is not always synonymous with quality.

Having thus briefly shown the state in which I hand over the Society to my successor, I may I hope be excused if I express my full belief that under his reign the present good state of affairs will be more than maintained; because, if the gentleman who has been proposed be elected, as I have no doubt he will be unanimously, you will have a man far better qualified than myself to command respect both by his years and his experience, and who will, I venture to predict, fully realise our hopes raised by his past services to the Society. One word more and I have done, but that word is to be said in the most emphatic manner, as I feel it would be unjust for me to sit down without a mention of the chemists at Somerset House. Both personally and in my capacity as your President, many facts have come to my knowledge which enable me to bear public testimony to the immense pains and care exercised by Mr. Bell and his colleagues on the samples submitted to them. It is true that, in a few instances, they have been obliged to differ from the conclusions of some of our members, but they can only judge upon the sample they receive, and I am sorry to say I do not always believe the samples to strictly represent those sent to the analyst; but in most cases, where the samples were genuine, their conclusion has borne out that of the analyst. I make it purposely a point, from a sincere conviction of its truth, of making this justly complimentary reference the last of my public acts as your President. Now, gentlemen, my task is over, and in bidding you farewell, let me urge you to work, observe, and communicate your results. Chemistry is essentially a science built up by the collection of small facts, and no observation, carefully made, however apparently simple, but will aid in attaining the grand arcana. Let us then continue to prosecute researches at every spare moment, so that Great Britain may continue to be, what she is undoubtedly at present, the nursery of the science of food analysis.

Dr. Bartlett proposed, and Mr. Dyer seconded, a vote of thanks to Dr. Muter for the efficient manner in which he had conducted the business of the Society during the year, and the manner in which he had sustained the credit of the Society.

The ballot papers were opened by the Scrutineers, Messrs. Hehner and Hobbs, who reported that the following gentlemen had been duly elected as Officers and Members of Council for the current year:—

President.

C. Heisch, F.C.S., F.I.C.

Vice-Presidents.

J. Muter, Ph.D., M.A., F.C.S., F.I.C.
A. Wynter Blyth, M.R.C.S., F.C.S., F.I.C.
M. A. Adams, F.R.C.S., F.C.S.

Treasurer.

C. W. Heaton, F.C.S., F.I.C.

Hon. Secretary.

G. W. Wigner, F.C.S., F.I.C.

Other Members of the Council.

A. H. Allen, F.C.S., F.I.C.
H. C. Bartlett, Ph.D., F.C.S.
A. Dupre, Ph.D., F.R.S., F.C.S., F.I.C.
J. West Knights, F.C.S.
F. Maxwell Lyte, F.C.S., F.I.C.
J. W. Tripe, M.D.

The names of those Members of Council whose terms of office has not yet expired, and who, consequently, do not retire this year, are:—

J. Carter Bell, F.C.S., F.I.C.	Bernard Dyer, F.C.S., F.I.C.
J. Campbell Brown, D.Sc., F.C.S., F.I.C.	Otto Hehner, F.C.S., F.I.C.
C. A. Cameron, M.D., F.R.C.S, F.I.C.	W. Wallace, F.C.S., F.I.C.

The Scrutineers also reported that for the office of Second Secretary two gentlemen had received an equal number of votes.

They further reported that the following gentlemen had also been duly elected:—

As Honorary Members—Michel E. Chevreul, F.R.S., of Paris; C. Remigius Fresenius, Ph.D., of Wiesbaden; A. W. Hofmann, D.C.L., F.R.S., of Berlin. As Member—W. Hodgson Ellis, Public Analyst for District of Toronto, Canada. As Associates—W. Bouchier, Assistant to Dr. Bernays; B. A. Burrell, Assistant to T. Fairley.

The following gentlemen were proposed as Members of the Society, and will be balloted for at the next meeting:—Thomas Stevenson, M.D., F.C.S., F.I.C., Guy's Hospital; Horace Swete, M.D., F.C.S., of Worcester; W. Douglass Hogg, of Paris; Dr. Paul Vieth, of London; H. J. Yeld, M.D., F.C.S., of Sunderland; W. Johnstone, of King's Lynn, and J. J. Broadbent, F.C.S., of Charing Cross Hospital.

Dr. Muter proposed, and it was carried unanimously, that a vote of thanks be given to the Chemical Society for the use of their rooms during the past year.

A vote of thanks to the Members of Council for their services during the past year was proposed and carried unanimously, and suitably acknowledged by the Past President.

Dr. Dupré moved, and Dr. Bartlett seconded, a vote of thanks to the Secretaries for their services during the past year, which was carried.

The Annual Dinner was afterwards held at the Café Royal, Regent Street, where, notwithstanding the inclemency of the weather, many of the Members and their friends passed an agreeable evening.

The next meeting of the Society will be held at Burlington House, on Wednesday, the 16th February, at Eight o'clock.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

The purity of the water supply of the large towns of England has been for a long time a prominent matter in the consideration of the public, and a matter of almost daily discussion in the leading London and Provincial newspapers, as well as a certain and somewhat lengthy source of argument year by year before Parliamentary Committees and in the House of Commons itself.

A certain section of the public have taken the matter up from the standpoint that a water supply for drinking purposes, ought to be not only free from all injurious constituents, but that, in order to be perfectly satisfactory, it should practically possess the characters of distilled water as far as regards freedom from either organic or inorganic constituents. Following their opinion to its logical conclusion, these persons naturally conclude that no river supply could by any chance be fit for household use, and that no matter how much the proportion of drainage matter which may find its way into a stream is oxidised, even by flowing 20 miles down the stream, its injurious effects were liable to be as bad as when it was originally poured in.

Others, again, hold that water from deep wells in the chalk strata, containing a large quantity of lime salts, although organically pure, is liable to produce, or any rate to increase, certain diseases, by introducing too large a quantity of earthy salts into the system.

It is not the business of the Society of Public Analysts to decide between these and the various other statements which have been made, but the proposals for legislation which occur from year to year in reference to water supplies, render it very desirable that authentic and reliable information as to the actual analyses of the various waters used, not only in London, but also in the leading towns of the kingdom, should be in the hands of those whose duty and interest it is to guide the national deliberations on the subject.

In order to meet this public necessity, the Society of Public Analysts have discussed the matter and decided to publish a monthly series of analyses, which shall be made on a perfectly uniform system, somewhat more full than those which have been previously in nse. This series will include not only monthly analyses of the London waters, and as far as practicable all the towns included in the Registrar-General's reports, but in addition to these, periodical analyses, at longer or shorter intervals as the case may be, of the water of any other towns in which the supplies seem of a sufficiently public character, and the population is sufficiently large to justify such a step.

At present neither the Society nor its members (by whose signature the returns are authenticated) express any opinion whatever as to the relative qualities of the waters, beyond those contained in the figures and facts of the analyses themselves, although it is possible that at a future time some such expression of opinion may be made.

The details of the analyses are, however, so complete, that those who are in the habit of collating such results can form a fair judgment for themselves.

There are several special features in the scheme which require notice. The analysts who are co-operating in it are working on uniform instructions, and accordingly to absolutely uniform processes; the result is that, for the first time, a fair comparison can be made between the water supplies of London and of the provincial towns. The analyses are not only fuller than heretofore published, but some important modifications have been made, especially as regards the temperature at which the determination of oxygen absorbed is made, which, although altering these analyses slightly from those which have preceded them, yet do in the opinion of the Society greatly increase the delicacy of the analyses for the detection of pollution.

The form in which the analyses are reported, namely, by giving the results in grains per gallon, has been adopted after mature deliberation, as that which, in the judgment of the majority, would render the analyses most valuable to those who have to consult the tabulated figures.

The instructions under which the analysts are working are in print, and the Secretary will be happy to furnish a copy of them to any person interested in water analysis on receipt of a request for the same.

The Editors of this journal will endeavour, from month to month, to publish the particulars of the sources of any public supplies of which it may be possible to obtain authentic and reliable details, and some of these particulars are published in this number.

The returns for next month will probably comprise all the missing places in the Registrar-General's list of large towns, and probably some six or eight places not included among those reported on in this number.

DESCRIPTION OF THE SOURCES OF SUPPLY AND METHOD OF FILTRATION (IF ANY).

LONDON COMPANIES.

The Chelsea Company's water, Grand Junction Water Company's water, the Lambeth Company's water, the Southwark and Vauxhall Company's water, and the West Middlesex Company's water are all pumped from the Thames, but at somewhat different points. The mode of filtration also differs considerably. The following are the particulars of these supplies :—

The Kent Water Company draw their supply entirely from deep wells in the chalk. Of these there are two at Crayford, 150 feet deep, which yield over 2 million gallons per day; and an additional one, 150 ft. deep, has been sunk at Orpington. Three others at Deptford, and two at Shortlands, are 250 feet deep; and one at Plumstead is 500 feet deep. The water does not require filtration. The Company have 9 reservoirs, the whole of which are covered. The Company supplies an estimated population of 308,300 people.

New River Company draw their supply partly from Chadwell Spring, near Hertford, which produces between 4 and 5 million gallons daily; partly from the River Lea, from which (at a point also near Hertford) they take from 15 to 22¼ million gallons daily; while they have also deep wells at several other places, from which large further supplies are drawn from the chalk as need requires. The subsiding and storage reservoirs for unfiltered water are capable of holding nearly 170 million gallons, and the covered service reservoirs for filtered water about 30 million gallons. The filtering beds consist of a 2 ft. 3 inches thickness of sand, or a 3 ft. thickness of gravel or other supporting material. The average rate of filtration is about two gallons per hour per square foot of filtering area. The Company supplies an estimated population of nearly one million people.

East London Company draw their supply from the River Lea, at Chingford. They have also the power of taking a certain quantity from the Thames, at Sunbury, which they occasionally exercise. The capacity of the storage and subsiding reservoirs for unfiltered water is about 605 million gallons, and of the reservoirs for filtered water 12 million gallons. The filtration is effected through sand, 2 ft. 6 inches; coarse gravel, 1 foot; boulders, 1 foot. The average rate of filtration is about 1·3 gallons per hour per square foot of filtering area. The Company supplies an estimated population of about 960,000 people.

Southwark and Vauxhall Company.—The intake is from the Thames at Hampton, almost adjoining that of the Grand Junction Company. The reservoirs for unfiltered water are capable of holding nearly 66 million gallons, and those for filtered water about 18 million gallons. The filtering material consists of Harwich sand, 3 feet; hoggin, 1 foot; fine gravel, 9 inches; coarse gravel, 9 inches. The average rate of filtration is about 1·5 gallons per hour per square foot of filtering surface. The Company supplies an estimated population of 684,000 people.

West Middlesex Company.—The intake is from the Thames at Hampton, very close to the intake of the Grand Junction Company. The reservoirs for subsidence and storage of unfiltered water are capable of holding nearly 92 million gallons, and the reservoirs for filtered water about 11 million gallons. The filter beds consist of Harwich sand, 2 ft. 3 inches; Barnes sand, 1 foot; gravel, 2 feet 3 inches. The average rate of filtration is about 1¼ gallon per hour per square foot of filtering surface. The Company supplies an estimated population of nearly 430,000 people.

Grand Junction Company.—The intake is from the Thames at Hampton. The capacity of the subsiding and storage reservoirs for unfiltered water is nearly 64½ million gallons, and the capacity of the reservoirs for filtered water about 24 million gallons. The filter beds consist of layers, commencing from above downwards of Harwich sand, 2 ft. 6 inches; hoggin, 6 inches; fine gravel, 9 inches; coarse gravel, 9 inches; boulders 1 ft. The average rate of filtration is nearly 1¾ gallons per hour per square foot of filtering surface. The Company supplies an estimated population of 390,000 people.

Lambeth Company—The intake is from the Thames at Molesey. The reservoirs for unfiltered water have a capacity of 125 million gallons, and those for filtered water a capacity of about 30 million gallons. The filtering beds consist of Thames sand, 3 feet; fine gravel, 1 foot; coarse gravel, 3 feet. The average rate of filtration is 3·5 gallons per hour per square foot of filtering area. The Company supplies an estimated population of 463,000 people.

Chelsea Company.—The intake is from the Thames at Molesey. The capacity of the reservoirs for the storage of unfiltered water is 140 million gallons, and for filtered in water 11 million gallons. The filtering beds consist of Thames sand, 3 ft. 3 inches; shells, 3 inches; gravel, 4 ft. 6 inches. The average rate of filtration is about 2 gallons per hour per square foot of filtering surface. The Company supplies an estimated population of 225,000 people.

It may be convenient to tabulate the details as to these London waters thus:—

TABULATED DETAILS OF LONDON SUPPLIES.

	Kent.	New River	East London	Southwark and Vauxhall.	West Middlesex	Grand Junction	Lambeth.	Chelsea
Capacity of Reservoirs Unfiltered..	none.	170,000,000	605,000,000	66,000,000	92,000,000	64,500,000	125,000,000	140,000,000
Filtered	”	30,000,000	12,000,000	18,000,000	11,000,000	24,000,000	30,000,000	11,00,0000
Filter Beds....................	”	14½ acres	27 acres.	14 5 acres.	10 acres	10 75 acres.	7 acres	6 75 acres.
Fine Sand	”	2 ft. 3 in.	2 ft. 6 in.	3 ft.	2 ft. 3 in.	. 2 ft 6 in.	3 ft	3 ft 3 in.
Hoggin	”			1 ft.		6 in.		
Coarse Sand	”				1 ft.			
Shells	”							3 in.
Fine Gravel	”	3 ft.		9 in.	2 ft. 3 in.	9 in.	1 ft.	4 ft. 6 in.
Coarse Gravel	”		1 ft.	9 in.		9 in.	3 ft.	
Boulders....................	”		1 ft.			1 ft.		
Average rate of Filtration per square foot per hour	”	2 gallons.	1·3 gallons.	1·5 gallons.	1¼ gallons.	1¾ gallons.	3·5 gallons.	2 gallons.
Estimated Population supplied..	303,300	1,000,000	960,000	684,000	430,000	390,000	463,000	225,000
Average Quantity Pumped Daily.	8,500,000	29,000,000	26,000,000	24,000,000	10,500,000	11,700,000	16,000,000	9,000,000

PROVINCIAL TOWNS.

Cambridge.—The supply is obtained by means of a tunnel in the chalk rock, at Cherry Hinton, about two miles from Cambridge, from whence it is conveyed in cast-iron pipes, and pumped up to a covered service reservoir for the supply.

Canterbury.—This water is derived from springs in the chalk, which in this neighbourhood is about 700 feet in thickness. There are two wells, and the first water fissure tapped was at a depth of 828 feet below the surface, or 290 feet below sea level. The temperature of the water as pumped is 51° F. The water is softened by Clark's process, in tanks, holding 100,000 gallons each, and after the subsidence of the carbonate of lime, the clear water is pumped up to covered reservoirs, from whence it descends by gravitation to the city. Attempts, which will probably be successful, are being made to recalcine the deposited carbonate of lime.

Exeter.—The water is drawn from the River Exe, above the confluence of its tributary the Culme. A conduit conveys the water from thence to the pumping station, from whence it is pumped to the reservoir, filters and distributing reservoir at Danes Castle; another reservoir for the high pressure service being placed at a higher level. The supply is intermittent. The sewage of Tiverton, which is situated about 10 miles above the works, is a source of pollution to the river. The River Dart, the water of which is highly coloured with peaty matter, discharges into the Exe, near Tiverton, which again interferes with the purity. The filtering material used is Haldon sand, which is composed of coarse grains of quartz derived from the disintegration of rocks, and sand from Paignton, derived from the degradation of rocks belonging to the new red sandstone series. A sediment left on the sand is sufficient to necessitate the removal of three inches of the surface of the filtering beds every two months.

Huddersfield is supplied from Blackmoor Foot reservoir, which has a capacity of 700 million gallons. This reservoir is fed by two conduits, having a total length of about seven miles, one running from the millstone grit moorlands on the Marsden side, the other through similar moorlands on the Merton side, where it takes in a mountain stream, which supplies a large proportion of the water. The conduits are cut through beds of peat, shale and clay. The shale is in places somewhat ochrey, but the clay is remarkably free from compounds of lime and magnesia.

King's Lynn is supplied from a stream called the Gaywood River, a portion of which is diverted into the waterworks at a short distance outside the town, and drawn simultaneously through a pair of filter beds. The river which brings the water to the town is about seven miles in length, and the water is mainly derived from one great water-bearing stratum in the chalk; the river passes through the oolites, touches the upper green sands, and finally traverses the silt at Lynn.

Leeds.—The supply is collected in the valley of the Washbourne, about 15 miles north-west from Leeds; the gathering grounds are chiefly moorlands covered with peat and heather; a small portion of the land is pasture. The substrata are shale in some parts, but chiefly millstone grit.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in January, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	pale blue	slight	1·35	none	·3000	·0009	·0033	·0040	·0100	16·8°	3·8°	20·05	sand, vegetable debris	Wigner & Harland.
New River	c., faintly tinted	none	·84	traces	·2930	·0020	·0010	·0020	·0370	14·4°	4·1°	23·80	none	B. Dyer.
East London ..	greenish	none	1·35	h. traces	·0800	·0055	·0117	·0100	·0700	16·0°	7·4°	23·45	sand, vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	pale yellow	none	1.24	traces	·1690	·0005	·0050	·0020	·0440	17·5°	5·0°	28·80	satisfactory	J. Muter.
West Middlesex	c. yellow	none	1·09	traces	·2600	·0018	·0060	·0050	·0860	18·0°	4·6°	23·44	Amorphous organic matter	O. Hehner.
Grand Junction	f. yellow	none	1·12	traces	·1254	·0011	·0053	·0038	·0488	15·1°	4·0°	21·80	none	A. Wynter-Blyth.
Lambeth	marked yellow	slight	·96	traces	·1570	·0007	·0070	·0047	·1250	17·0°	4·8°	24·50	veget. debris, moving	J. Muter.
Chelsea	greenish yellow	none	·95	h. traces	·1460	·0010	·0062	·0056	·0700	16·5°	7·5°	23·24	none [organisms	A. Dupré.
Birmingham ..	f. yellow	none	·98	traces	·1610	·0020		·0080	·0360	13·9°	7·1°	22·60	none	A. Hill.
Bradford	f. dirty yellow	none	·75	none	none	none	·0070	·0168	·1400	4·2°	3·7°	7·80	none	F. M. Rimmington.
Cambridge	faint blue	none	1·57	h. traces	·4030	·0007	·0021	·0039	·0616	18·5°	6·0°	24·50	none	J. West-Knights.
Canterbury	clear blue	none	1·47	none	·3460	·0006	·0008	·0040	·0080	7·0°	4·0°	10·64	traces mineral	S. Harvey.
Croydon	f. green	earthy	1·12	traces	traces	·0100	·0110	none	·0300	15·0°	8·0°	23·80	none	C. Heisch.
Derby	v. good	none	·99	none	·1100	·0031	·0131	·0080	·0120	10·3°	3·8°	21·00	trace veg. matter	Wigner & Harland.
Exeter	f. yellow	none	·84	traces	·2300	·0007	·0045	none	·0343	2·8°	2·8°	7·00	none	F. P. Perkins.
Grantham	greenish blue	none	1·12	traces	·7220	·0010	·0025	none	·0110	16·7°	5·5°	23·13	none	A. Ashby.
Huddersfield ..	brownish yellow	rain w.	·50	traces	·0080	·0070	·0060	·0020	·0195	2·1°	1·5°	4·60	none	G. Jarmain.
Hull	good	none	1·30	traces	·4100	·0005	·0021	·0015	·0050	16·0°	3·5°	22·80	none	J. Baynes.
King's Lynn ..	milky opaque	slight	1·55	h. traces	·3260	·0538	·0028	·0300	·0630	16·1°	5·3°	28·75	Amorphous organic matter	W. Johnstone.
Leamington ..	greenish	none	1·40	none	none	·0014	·0035	·0010	·0140	28·4°	17·5°	30·80	none	A. B. Hill.
Leeds	light brown	peaty	·62	traces	none	·0003	·0030	·0200	·1100	5·2°	2·9°	6·44	sand, peaty matter	T. Fairley.
Manchester....	slightly turbid	peaty	·75	traces	none	·0025	·0040	·0053	·0516	1·9°	1·7°	4·75	none	W. Thomson.
Newcastle-on-Tyne......	f. yellow	none	·88	traces	·0600	·0010	·0090	·0110	·0700	16·6°	5·0°	21·30	none	J. Pattinson.
Norwich	peaty	none	1·90	traces	traces	traces	·0072	·0100	·0680	17·0°	4·5°	22·80	none	W. G. Crook.
Oldham, Piethorn	dirty yellow opaque	slight	·71	v. h. traces	·0800	·0087	·0082	·0060	·0820	2·7°	2·0°	5·40	vegetable debris	Wigner & Harland.
Do. Strinesdale	yellowish opaque	slight	·71	v. h. traces	·1100	·0025	·0027	·0010	·0700	5·7°	5·0°	10·00	animal and vegetable debris	Wigner & Harland.
Salford	c. yellow	slight	·50	none	none	·0005	·0030	none	·0250	3·5°	3·0°	4·00	none	J. C. Bell.
Sevenoaks	colourless	none	1·22	traces	·2660	·0060	·0010	·0010	·0330	13·1°	3·8°	19·88	none	B. Dyer.
Sheffield	brownish turbid	none	·50	none	none	·0021	·0049	none	·0970	4·0°	4·0°	5·81	none	A. H. Allen.
Shrewsbury ..	colourless	none	1·26		·3700	·0020	·0040	none	·0070	22·8°	5·0°	27·60	none	T. B. Blunt.
Sunderland....	pale blue	slight	1·99	traces	·2500	·0017	·0028	·0060	none	9·7°	3·8°	25·80	vegetable matter	Wigner & Harland.
Warwick	greenish yellow	slight	1·19	traces	·1540	·0028	·0049	·0080	·0530	21·0°	17·2°	21·00	none	A. B. Hill.

ON THE IDENTIFICATION OF THE COAL-TAR COLOURS.*

By John Spiller, F.C.S.

Dyers and others who are in the habit of using the coal-tar colours are familiar with a number of chemical reactions by which the members of the series may generally be classified and identified. Differences are remarked in their relative affinities for various sorts of fibres, some colours being taken up freely by silk, others fixing better upon wool, and some few, like saffranin, exhibiting a special affinity for cotton. Again, as with the yellows, great differences are observed when the operator proceeds to work with a free acid or a weak alkali in the dye-bath. Primrose (naphthaline yellow) requiring the former, but not so with phosphorine (crysaniline yellow), which demands a neutral or even slightly alkaline bath.

By the study of these conditions, aided by a few characteristic tests, it is often possible to identify colouring matters of unknown or doubtful origin, and it is with the view of extending the number of such readily available tests that I recommend a more frequent appeal to the colour reactions with sulphuric acid.

For this purpose but small quantities of material are required, a few grains serving to impart a distinct colour to a comparatively large bulk of sulphuric acid, and the resulting indications are in many cases both specific and permanent. Oil of vitriol, which so readily destroys nearly all organic structures, does not carbonise any of the coal-tar colours, or does so only under severe conditions, as at high degrees of heat. Even indigo and madder, although of true vegetable origin, are known to yield up their colouring-matters to sulphuric acid, the old process of dyeing depending upon this fact. In the manufacture of garancine from madder the woody fibre and organised tissues are destroyed by the action of sulphuric acid, whilst the alizarin glucoside survives, and with it Turkey-red goods may be dyed.† Instances might be multiplied as proof that colouring-matters, both natural and artificial, resist the attack of oil of vitriol, and the large class of sulphonates (Nicholson blues, "acid roseine," &c.) may be cited as establishing the fact that colouring-matters are not so destroyed, but form combinations with sulphuric acid.

If, then, the body under examination be dissolved in strong oil of vitriol, a colour-test is at hand whereby useful inferences may be derived as to the nature of the dye, and often its exact identity disclosed. A few direct confirmatory tests may then be applied. The most remarkable colour reactions are the following:—

Magdala (napthaline pink).........	Blue-black.
Saffranin..............................	Grass-green, becoming indigo-blue on strongly heating.
Crysödin..............................	Deep orange, turning almost to scarlet on heating.
Alizarin	Ruby-red or maroon.
Eosin	Golden yellow.
Primrose (napthaline yellow)......	Difficultly soluble, first yellow, and colour discharged on heating.
Crysaniline	Yellow or brown solution, of marked fluorescent character.
Aurin	Yellowish brown, non-fluorescent.
Atlas orange	Rose colour, turning to scarlet on heating.
Atlas scarlet	Scarlet solution, very permanent on heating.

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* Read before the Chemical Section of the British Association, Swansea Meeting.

† See W. H. Perkin's "History of Alizarin," *Journ. Society of Arts*, May, 1879.

Biebrich scarlet, R.	Blue-black or deep purple.
" " B.	Bluish green.
Aniline scarlet	Golden yellow, permanent on heating.
Indulin	Slatey blue to indigo, according to shade of the dye.
Rosaniline, regina, and all violets	Yellow or brownish yellow.
Phenyl and diphenylamine blues	Dark brown solutions.
Iodine green	Bright yellow solutions, the former giving off iodine on heating.
Malachite green	
Citronine	Pale cinnamon or neutral tint.

After vitriol the action of concentrated hydrochloric acid may be next tried, which distinguishes at once between saffranin and Biebrich scarlet, the former giving a violet solution and the latter being precipitated as a red flocculent powder.

Proceeding in this way, and combining the observation with the dyer's usual test, every one of the substances named can be readily identified, and much time saved in the examination of dye-stuffs.

ADULTERATION IN AMERICA.

In continuation of the Abstracts of Essays in our last number we now give one or two others.

The third prize essay is by Dr. W. H. Newell, and the only clauses at all interesting to English analysts are those which are embodied in the proposed Laws as definitions of offences, and the following which relate to the appointment of Boards of Health and Analysts.

STATE LAW BY "OVERCOME EVIL WITH GOOD."

An Act, entitled, an Act to regulate the manufacture and sale of food, and the adulteration of the same. Be it enacted by the Senate and General Assembly of the State of—

That the Governor shall appoint seven persons, who together with the Secretary of State and Attorney General, as ex-officio members, shall constitute the Board of Health of State of—

The persons so appointed shall hold their offices for seven years.

Provided: that the terms of office of the seven first appointed shall be so arranged that the term of one shall expire each year, and the vacancies as created as well as all vacancies occurring otherwise shall be filled by the Governor.

They shall appoint a chairman, who shall call meetings as often as every............months or when requested to do so by any three members of the board; they shall in the month of............ make report to the Governor of their investigations and opinions during the year ending............ with such suggestions as they may deem necessary.

The board shall elect a secretary from their own number, who shall superintend the work prescribed in the law, as the board may require.

Every city or borough or incorporated town, or any town governed by a commission, shall have a board of health, of not less than five, or more than seven members; of which the keeper or recorder of vital statistics, and also one city physician, and city health inspector, shall be members, if there be such officer or officers; and the said board of health shall be nominated by the mayor, and approved by the common council or other governing board of the city, borough or town, to serve for not less than three years, but not more than three of the number shall go out of office at one time, unless in case of removal by death or change of residence.

In such township of State outside of city limits, the township committee, together with the assessor, and the township physician, if there be such an officer, shall constitute the Board of Health for all of said township outside of city limits; and shall have the same powers as are possessed by any city board of health, within the State, so far as this could relate to any unincorporated district.

Every local Board of Health of any city, borough, town or township, shall on or before the first of each year, in addition to any other report that the local authorities may require, prepare an annual report, concerning the adulteration of food in their district, and shall therein answer any enquiries which have been addressed to them by the State Board of Health: in the case of cities the same shall be presented to the city authorities; and the Board of Health shall on or before the fifteenth of the above month of each year, forward a copy of the same to the address of the State Board of Health.

For the purpose of fulfilling the requirements of this Act, the State Board of Health may aid any local board to the amount of............dollars in any one year; and also for the purpose of fulfilling the requirements of this Act, the State Board of Health be authorised to expend............dollars each year; said expenditure to be accounted for each year, by itemized bills, audited by the president and secretary of the State Board of Health, and approved by the Governor.

In case of any county having a county board of health nothing in this bill shall change or modify their former power or jurisdiction, and they shall possess all the authority herein granted to city or township boards: and they shall yearly report to State Board of Health in the same way, as is required in counties where there is no county board of Health; nothing in this Act shall relate to or effect any city board of health now organised in any of the cities of this State, under the provisions of their respective charters.

The State Board of Health and all boards of health appointed in the different counties of this State, shall take cognizance of the interests of the public health as it relates to the manufacture and sale of food and the adulteration of the same; they shall make all necessary investigations and inquiries relating thereto, and fulfil all the provisions of this Act.

The clauses defining offences are as follows, and, as will be seen, are almost identical with the English Acts :—

First—For the purpose of this law the term "food" shall include every article used for the food and drink, or in the food and drink of man and animals.

Second—The standard by which the offence of adulteration shall be judged, or the degree in which the offence may have been committed, shall be:

For simple articles of food, a fair average quality of the substances in their natural condition, or as best prepared by drying, grinding, packing, etc., without damage from their natural condition.

For compound articles of food—the publicly known formulas or patents, whereupon they should be compounded; or the labels, or descriptions, attached to the compounds as given, sold, offered, or held in possession.

In the case of proprietary or proprietary private compounds, the constituents of which are legally held as secrets, the testimony of the owners of the private formulas shall be accepted as evidence of the character of the compound.

Provided, That nothing herein contained, shall be construed so as to protect or permit the issue of any compound, which contains any poisonous or hurtful ingredients, not publicly stated and professed by the label, attached to the compound when given, sold, offered, or held in possession.

Third—For the purposes of this law, the offence of adulteration shall be as follows: The adding of one or more substances to another, or others, whereby the strength, purity, quality, or true value of the resulting substance or mixture, is reduced or lowered in its nature or composition, with the effect of tending to deceive the public by lowering such substance or mixture from its original and true value, or allowing the public significance and common meaning of the name by which it was or is originally known or used.—(Examples: corn meal in flour; chicory, &c., in coffee; terra alba in cream tartar).

The substitution of one substance for another, either wholly or in part, with the effect of tending to deceive or mislead the public, or any part of them.—(Examples: artificial wines, liquors and mixtures, artificial mustard).

The abstraction of any substance, with the effect that the separation shall reduce the value of the substance, and thus tend to deceive or mislead by changing the common significance of the name, by which as a whole the substance was originally applied to use.—(Cream from milk, partly exhausted coffee and tea).

The application of a name commonly known or understood to indicate any substance, to any part or parts thereof, or to any other substance, with the effect of tending to deceive and mislead.—(Oleomargarine for butter, potato starch for arrowroot).

The admixture of different qualities of the same substance, with the effect of tending to deception and fraud.—(Canned provisions, damaged wheat in flour.)

Any debasement or dilution of any substance, whereby it is reduced in intrinsic value and is yet liable to be given, bought, sold or used as though it were not debased or diluted.—(Examples, diluted milk and vinegar).

Any mixing, colouring, staining, coating, polishing, or powdering, or any other alteration in the physical condition or sensible properties of any substance, with or without addition to or substraction from it, whereby damage is concealed, or it is made to appear better or greater than it really is, either in quality, weight, or measure, or whereby impurities or defective quality are partially or wholly marked or hidden with the effect of tending to deceive or mislead.—(Colouring or polishing of green coffee, bread from damaged or mixed flour, large bread of short weight).

The giving, or selling, or offering for sale, or the possession of any adulterated article by any person whose business it is to make or to deal in articles of food, shall be *prima facia* evidence of the offence of adulteration.

Provided, That it be and it is hereby declared to be the sole and entire object and intention of this law to protect the public against deception and fraud in the cost and quality of food through adulteration, and all the provisions of this law shall be construed and applied in accordance with its sole object, by the rules of common law.

No person shall adulterate nor cause nor permit any other person to adulterate any article of food, under a penalty in each case not exceeding.................. dollars fine for first offence. But every offence after a conviction for a first offence shall be a misdemeanor, for which, on conviction, the person shall be imprisoned with hard labour for a period not exceeding.................. and fined not exceeding...,............ dollars.

No person shall give, or sell, or offer for sale, or hold, under the ordinary conditions of saleable commodities, any adulterated articles of food, under the same penalties as in the preceding section.

No person shall give, or sell, or offer for sale, or hold, under the ordinary conditions of saleable articles, any food which may have become through natural or accidental causes, deteriorated, or adulterated, so as to be unfit for common use, under the same penalties as in the preceding section.

The essay by Dr. O. Wight, which is recommended for printing, embodies a draft bill, the principal clauses of which are as follows :

A BILL TO PREVENT THE ADULTERATION OF FOOD AND DRINK.

The People of the State of................represented in Senate and Assembly, do enact as follows :

Section 1. Every person who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly manufacture any poisonously adulterated food or drink of man, from the effects of which food or drink any other person dies, either within or without the State, shall be deemed guilty of manslaughter, and shall be punished by imprisonment, either with or without hard labour, not more than twenty years.

Section 2. Every person who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly offer to sell or give away, or knowingly manufacture, or knowingly transport or receive, any poisonously adulterated food or drink of man, from the use of which food or drink any other person might die, shall be deemed guilty of an attempt to commit the crime of manslaughter, and shall be punished by imprisonment, with or without hard labor, not more than three years, and by a fine of not more than one thousand dollars.

Section 3. Every person, who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly manufacture, any adulterated food or drink of man, from the use of which food or drink any other person receives serious injury to health, shall be deemed guilty of a misdemeanor and shall be punished with imprisonment, with or without hard labour, not more than two years, or by a fine of not more than one thousand dollars.

Section 4. Every person who, within the limits of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly offer to sell or give away, or knowingly manufacture, or knowingly transport or receive, any adulterated food or drink of man, from the use of which food or drink any other person receives serious injury to health, shall be deemed guilty of a misdemeanor and shall be punished by imprisonment, either with or without hard labour, not more than one year, or by a fine of not more than five hundred dollars.

Section 5. Every person who, within the jurisdiction of this State, shall knowingly sell or give away, or knowingly cause to be sold or given away, or knowingly offer to sell or give away, or knowingly manufacture, or knowingly transport or receive, any food or drink of man, which food or drink contains any additional substance, beyond what may be necessary for its collection, manufacture or preservation, that sensibly increases its weight, bulk or strength, or gives it a fictitious value; or from which any important constituent has been wholly or in part abstracted or omitted; or which is an imitation of, or under the name of another article; unless such necessary additional substances, or such abstracted or omitted constituent, or such imitation or change of name be acknowledged and declared at the time of sale or transportation, and be clearly stated in all invoices and bills of sale thereof, and be announced in writing or print on a label firmly and durably attached to any package or parcel of whatsoever kind or nature, containing such food or drink; shall be deemed guilty of a misdemeanor and shall be punished by a fine not exceeding three thousand dollars.

Section 6. Every article of food or drink of man found within the jurisdiction of this State, which article contains any ingredient rendering the same dangerous to the life or injurious to the health of a consumer thereof, shall be liable to seizure and condemnation, and when seized and condemned shall be deemed contraband of commerce and destroyed.

Section 7. Every article of food or drink of man, found within the jurisdiction of this State, which article contains any unnecessary substances giving the same a ficitious value, or from which any important constituent has been wholly or in part abstracted or omitted, or which is an imitation and under the name of another article, shall, unless said article bears a label as provided in chapter Five of this Act, be liable to seizure and condemnation, and when seized and condemned shall be forfeited to the lawful use of the State.

REVIEW.

Spon's Encyclopædia of the Industrial Arts, Manufactures and Commercial Products.

Edited by Charles G. Warnford Lock. London: E. & F. N. Spon, 16, Charing Cross.

The third division of this excellent work has now been published, bringing down the subjects to the letter I. The present volume contains *inter alia* Cotton, Drugs, Dyeing and Dyestuffs, Electro-metallurgy, Explosives, Fibrous Substances, Floorcloth, Food Preservation, Fruit, Fur, Gas, Gems, Glass, Hair, Hats, Honey, Hops, Horn, Ice Making, and Indiarubber. Where all the articles are so excellent, it may appear invidious to select any for special commendation, but there are two which will be found specially interesting. The first is that on Electro-metallurgy, which has received an immense *impetus* through the introduction of nickel plating and the use of magneto-electric machines instead of batteries. The whole subject is very practically treated, but perhaps a few critical remarks about the merits of the various machines, and more especially that excellent one recently introduced by Mr. Elmore, which has been received with so much favour by practical men, would not have been out of place, as after all much depends on the continuity and easy running of the generator. The second article is that on Floorcloth, in which for the first time, so far as we know, the nature and manufacture of the article Linoleum is fully discussed. The author, in whose initials we recognise Mr. W. F. Reid, goes into the matter not only in the practical, but also in the scientific manner to be expected from a gentleman of his chemical training. He gives an interesting account of the solid substance obtained by the oxidation of linseed oil, and mentions that he finds the sulphuric acid test only to give approximate results in the determination of the quality of the oil. He employs a practical test, which is as follows: He heats the oil in an iron vessel with half per cent. of finely ground litharge, and the same of red lead, to a temperature of 260° C (500° F.), blowing at the same time air through the liquid. So soon as a little of the oil cooled on an iron plate appears "stringy," the heat is removed, and the whole stirred till cold. If the oil be genuine a perfectly solid substance results, but, if adulterated, it is more or less liquid according to the quantity of non-drying oil it contains. The article on Fibrous Substances is also very complete; and, in a word, the whole keeps up the excellent promise of the first volume.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

LARD ADULTERATION.

To the Editor of "The Analyst."

Sir,—Replying to Mr. Percy Smith's letter in your last number, allows me to say that a very large number of samples of lard have been examined by the Public Analysts in this part of the country, myself among the number, and scarcely a single adulterated sample has been found.

The only adulterant ever known, or at any rate found to be used, is water, which is occasionally introduced to the extent of some 10 or 15 per cent. This fraud is, however, very rare now.

The difference between the melting points of the different samples of lard which Mr. Smith tried, is mainly due, in all probability, to their containing different proportions of the oleine, which is a natural constituent of pig's fat, but is often pressed out from it and sold separately as a lubricating oil, under the name of lard oil. This treatment raises the melting point because lard oil has a lower melting point by many degrees than lard itself. The treatment also improves the lard and renders it more suitable for cooking purposes.

I am, Sir,

January 13th, 1881. AN INTERESTED ANALYST.

ANALYSTS' REPORTS.

At the Wiltshire Quarter Sessions, the report of the County Analyst, which was presented, stated that during the quarter analyses of salt butter, sugar, and coffee had been made. The salt butter was found to be adulterated with excessive water, but the samples of sugar and coffee were proved to be genuine.

At Somerset Quarter Sessions on Tuesday, the report of Dr. H. J. Alford, the recently appointed County Analyst, was presented. He stated that during the quarter he had not received any samples for analysis from the general public, but 314 from the inspectors, this number being largely in excess of former reports. The adulteration discovered was not such as was prejudicial to health. Butter was fairly good, except salt butter; chicory was mixed with coffee to a considerable extent, and the cocoa contained very little cocoa, but a good deal of starch. The reading of the analyst's comments excited much laughter among the magistrates, who used to have mere formal documents from the former analyst, Mr. W. W. Stoddart.

Mr. F. M. Rimmington, Analyst for Bradford, in his report for the quarter ending December 31st, states that—"Fourteen samples of milk have been submitted to me for analysis. These were all genuine, and of excellent quality; two samples of artificial butter, or butterine so called, and three samples of confectionery. Four samples of pepper have also been analysed, and found unadulterated. After a period of nearly six years, during which the Act has been in operation in the borough, it is reasonable to review the past, and see what has been gained. The samples of milk analysed during the past quarter are the best as regards quality that I have had since the commencement. Formerly we could not obtain milk which yielded more than 4 to 5 per cent. of cream, or 2 to 2½ per cent. of butter. Latterly the yield of these constituents has been from 7 to 10 per cent. of cream, and 3 to 4 per cent. of butter. I think, therefore, the borough may be congratulated upon having obtained a supply of good milk. About two years ago a good deal of attention was paid to the butter supply, and much of that which was sold was found to contain 4 or 5 per cent. of salt, which was said to be quite necessary for its preservation, and 20 to 25 per cent. of water, and some prosecutions were instituted. Judging from those samples brought to me during the past few months, the proportions of water have been reduced to 11 or 12 per cent., and the salt to 1 or 2 per cent. At the commencement of the Adulteration Act, proceedings for adulterated pepper and some other articles of this class were numerous, but for the last two or three years there has not been an instance of this kind of sophistication. On the subject of butterine perhaps I may be allowed to make some remarks. This artificial butter, when honestly made, is a preparation of beef suet, and so long as it is sold for what it is, nothing can be said against it on the score of wholesomeness—but assuming it to attain a more general use than it now has, the question suggests itself—What guarantee is there that it will always be obtained from sound and healthy beasts, and not from fat procured from other animals not usually killed in a slaughter-house. It is very doubtful whether the greatest vigilance would be sufficient to ensure the public from imposition and perhaps danger in this way. The subject is an important one. On the one hand a fat which is mainly used for making soap and candles is converted into a useful and economical article of diet; and on the other hand there is the possibility of nasty and unwholesome substances being foisted on the public under an alluring title. The subject has another phase of interest in relation to the public. The name "butterine" has been fixed upon for this substance. This term at once suggests that the article is a compound or preparation of butter. But this suggestion is a false one, as no butter enters into its composition. It is in this alluring idea, and the ease with which the terminal syllable can be dropped, that make it so easy to practice imposition, and sell it at a price double its real value."

"PREVIOUS SEWAGE CONTAMINATION," AS DEFINED IN THE *Brewers' Guardian.*—This expression repeatedly occurs in analytical reports on water, and, judging from several inquiries which have reached us, its meaning is but imperfectly understood. When a water percolates from the surface to some depth in a well it passes through a series of strata, each of which gives up some soluble constituents. Near the surface there is often an accumulation of animal and vegetable matters in a state of decay, which yield a considerable quantity of soluble nitrogenous matter, and even living organisms, to the water. Thus, shallow wells and rivers are not suitable sources of water supply, unless some efficient means of purification are adopted. When the water has to percolate into a deep well, even if it becomes charged at the surface with much organic impurity, it is gradually purified; the nitrogenous constituents undergo oxidation in passing through certain strata, and are thus gradually converted into nitrates. Should any organic matters either escape oxidation or percolate direct into the well, they will gradually exert a reducing action, and by taking away oxygen again from the nitrates, convert these salts into nitrites. Thus both nitrates and nitrites are produced from organic matters, and the determination of the quantity of nitrogen existing in the water in the form of these salts, gives us the "previous sewage contamination" or the oxidised nitrogenous impurities which at one time were present in the water. The presence of nitrates in a well water must therefore be considered a suspicious circumstance; although not hurtful in themselves, they are undoubted evidence of the existence of organic impurities at some stage of the water's progress, and it is possible that the oxidising action may not always be complete, and thus unconverted and previous nitrogenous matters may find their way into the well. Nitrites are even more dangerous, for, as a rule, they are the result of the action of organic matters on already-formed nitrates, and tend to show that these organic matters have either not been completely oxidised, or have found their way into the well direct.

CHICAGO.—At a recent meeting of produce dealers in this city, steps were taken and money subscribed towards looking to the prosecution of the dealers in adulterated goods. A committee was appointed to urge the prosecution of parties selling adulterated products as genuine. It is stated that there are fifteen factories in this city alone engaged in manufacturing so-called butter made from tallow, and latterly even from lard, and throwing it upon the market. This compound is called "butterine" or "suine," is made up in four grades, the best being 50 per cent. creamery butter and the other 50 per cent. an equal mixture of lard and beef tallow. As respects the fourth grade, its mysteries are unfathomable. Cheese is similarly adulterated, with the addition besides of soap-stone, caustic soda, and caustic potash. It is stated that these ingredients are at times so strong as to eat through the very staves of the barrels containing the article. Of course, the makers of such stuffs as these claim that they are not injurious. But such a claim must necessarily be false, and indeed is but feebly put forth. But this is not the point. Whether they are injurious or not, no party or firm should be allowed to sell any product which is not that which it purports to be. Nobody ought to be imposed on by persons selling under the broad ægis of mercantile honour, fictitious, deleterious, and even poisonous substances. It is contrary to public morals and public policy. As a matter of public policy, the manufacture of such substances and their sale as genuine, no matter how low the prices, must most assuredly drive good, healthy and pure articles out of the market. Not only so, but it will so injure the good name of the city and country as to cast suspicion upon their every product.—*Chicago Journal of Commerce.*

A patent for the manufacture of oleomargarine has just been published. Beef suet is melted in water, to which are added salt, carbonate of potash, chlorate of potash, and nitrate of soda. The fat is then conveyed to a separate vessel and fine salt added, the whole being agitated and allowed to cool, after which it is pressed.—*Grocer.*

LAW REPORTS.

Workhouse Milk in London.—Heavy Fines for Adulteration :—

Collison Hall, jun., of the Short Horn Dairy Company, 21 and 23, White Lion Street, Bishopsgate, was summoned before Mr. Lushington, at the Thames Police Court, for delivering to St. George's-in-the-East Workhouse, to the prejudice of the purchaser, a quantity of adulterated milk. There was another summons for supplying adulterated milk to St. George's-in-the-East Infirmary. Mr. Hannay, solicitor, defended, and pleaded guilty on behalf of his client, but urged in mitigation of punishment that the defendant had carried on business for more than forty years, and this was the first complaint against him that the milk he sold was adulterated. The milk referred to never came to the defendant's premises, but was taken direct from a railway station, where it arrived from the country, to St. George's-in-the-East Workhouse. It must have been tampered with at the station or in transit, as the carman who had been in charge of the milk absconded and left his horse and vehicle in the road. The defendant had exercised all the vigilance human ingenuity could do, and he had the foreman in court to prove what he had asserted. It was the custom at public institutions to test the milk before it was sent in, and then to inform the vendor whether it was adulterated or not, which ought to have been done in this instance. In answer to Mr. Lushington, William Rains, sanitary inspector of St. George's parish, said he took one sample of milk from the workhouse which was adulterated with 20 per cent. of water, and the other from the infirmary containing 20 per cent. of water. The afternoon delivery at the workhouse was 45 quarts, and rather more in the infirmary. He was not aware that the milk supplied by the defendant had been tested before. Mr. Lushington said the defendant pleaded guilty to both summonses, for supplying the infirmary and workhouse of St. George's with adulterated milk, and had entered into a contract to serve a very large quantity of unadulterated milk. He was bound to take sufficient steps to ascertain that the milk supplied by his servants was not adulterated, and it was not a case in which he could listen to anything like the infliction of a nominal penalty. He fined the defendant £10 on each summons.

Workhouse Milk in Dublin :—

In the Southern Divisional Police Court, Dublin, James Grennan, dairyman, has appeared at the suit of the Guardians of the South Dublin Union, who alleged that he sold and delivered milk at the Workhouse which was adulterated with 20 per cent. of water. It appeared that defendant was one of the contractors for the supply of milk to the Workhouse, and Alexander Frazer, storekeeper in the Workhouse, demanded one gallon of the forty-five gallons of milk that was being delivered one morning at the Union. This he had analysed by Dr. Cameron, who certified to 20 per cent. of added water. For the defence it was stated that the contract had been, from the beginning, executed by a dairykeeper named Collins, who had failed in getting the contract from the Guardians. Collins received all the moneys paid by the Guardians. It was also urged that inasmuch as Frazer did not pay for the milk, he had not complied with the Act of Parliament. The Magistrate held that the Act had been complied with, and fined the defendant £10, with two guineas costs, and refused to state a case.

Conviction for Refusing to Serve Inspector :—

William Kennarbey, of Putney, was summoned at the same time and place for refusing to sell milk to the inspector in a street for the purpose of being analysed. The defendant set up a defence that the inspector could only demand to be supplied at the shop. Mr. Shiel said the defendant was wrong in his law. The inspector then proved that the defendant had been fined 30s. for selling adulterated milk. Mr. Shiel now fined him 40s. and 2s. costs.

Summons for Selling "Prepared" Coffee :—

Peter Bratt, grocer and Italian warehouseman, who has numerous establishments in the city and borough, was summoned at the Salford Borough Police Court, on Thursday, before Mr. J. Mackinson the Stipendiary Justice of the Borough, by the Corporation under the Sale of Food and Drugs Act, 1875, for selling to the prejudice of the purchaser a tin of coffee known as "Franck's Prize Medal Coffee," which, it was alleged, was not of the nature, substance, and quality of the article demanded. Mr. J. C. Walker, Assistant Town Clerk of Salford, appeared in support of the summons, and Mr. Edge, barrister-at-law, appeared for the defendant. The case had been taken up by the Manchester and Salford Grocers' Association. Mr. Walker, in opening the case, said that on December 13th, Mr. Thompstone, the inspector for the borough, called at the defendant's shop, 189, Broad Street, Pendleton.

Mr. Bratt there carried on business under the style or firm of Bratt and Hobson. The inspector asked one of the defendant's shopmen for a quantity of coffee known as Say's coffee. The shopman said they did not keep Say's, but they had Franck's coffee and showed him a half-pound tin and recommended it. The inspector said he would take the half-pound tin, and paid 10d. for it, which was at the rate of 1s. 8d. per lb. This he (Mr. Walker) contended was a fair marketable price for good coffee. He should call witnesses who would tell the Court that coffee ranged from 1s. 6d. to 2s. per lb. Nothing was said by the shopman until after the purchase was completed as to the coffee being a mixture of coffee and something else. Mr. Edge here interposed, and said Mr. Walker had better read the label on the tin of coffee sold to the inspector—a label which was on the tins of Franck's coffee. Mr. Walker said he was coming to that point presently. The label went on to say a lot of praiseworthy things about this Franck's coffee, and on the one side in very small type it said: "Purchasers must ask for Franck's coffee which is sold as an admixture, and are particularly requested to see that every tin bears this label." The inspector was not told that this was anything but coffee, and he (Mr. Walker) contended that the words "sold as an admixture" were not sufficiently distinct. According to the 8th Section of the Act the notice that the article was an admixture must be "distinctly and legibly written or printed," and the notice on Franck's label was not printed sufficiently legible. His (Mr. Walker's) second point was that on the authority of the case Liddiard *v.* Reece, which was before the Court of Queen's Bench on November 28th, 1879, and reported in the *Justice of the Peace* of April 10th, a label of this kind was no protection to the seller, if the chicory, or whatever it might be, had been added for the purpose of fraudulently increasing the bulk of the article sold. Liddiard *v.* Reece was a case almost similar to the present one. An inspector went into a shop and asked for half a pound of coffee, for which he paid 9d. He took it for analysis, and after being told this the shopman pointed to the label on the wrapper, showing that it was a mixture of chicory and coffee. On analysis that coffee was found to contain 40 per cent. of chicory, and Mr. Justice Lush said, "I think here the case finds that the coffee was fraudulently mixed with intent to increase the bulk. If so, I cannot see how the label protects the seller." The fine imposed on the shopkeeper in that case was upheld, and Mr. Justice Lush said the conviction could not be interfered with. The Stipendiary: But in that case coffee was asked for. Did the inspector in this case ask for coffee? Mr. Walker: Yes; this tin was put before him as Franck's coffee. The fact of the words "Franck's coffee" does not make it of any more value, and I contend that the seller should inform the purchaser of the contents of the tin. If a person asks for Franck's coffee, he has a right to obtain coffee, and not a mixture of chicory and coffee. Mr. Walker then went on to quote another case from the same number of the *Justice of the Peace*, Hodder *v.* Meddings, in support of his contention that the ingredients must be stated on the label, and that if anything had been added to the coffee for the purpose of fraudulently increasing the bulk the seller was liable to a penalty. Mr. Mackinson: But here in the present case a specific article is sold to the inspector which is known as Franck's coffee, and which is stated to be an admixture on the label. Inspector Thompstone was then called, and stated that he visited Mr. Bratt's shop in Pendleton on December 13th. There were two assistants in the shop, named Percival and Scholes. Witness asked Percival for half a pound of Say's coffee. He said, "We have not got Say's; but we keep Franck's prize medal coffee, and have half-pound tins." Percival produced a half-pound tin, and he (witness) said "I will take this coffee," mentioning the word "coffee" again. The coffee was in the tin produced, and he paid 10d. for it, which was at the rate of 1s. 8d. per lb. Mr. Walker: Are you able to say that 10d. is a fair market price for coffee? —Yes; it is. Not mixture?—No. Nothing was said to me about its being anything but coffee until I had paid for it and said I wanted it for the purpose of being analysed. I noticed there was no mention of chicory on the tin. I divided the coffee into three parts in the usual way, and submitted a portion to the Borough Analyst, whose certificate states that it contained 20 per cent. of chicory. Chicory can be bought at 4d. and 5d. per lb. retail. Mr. Mackinson (the Stipendiary), without calling upon Mr. Edge for his defence, said the summons must be dismissed. In the first place, he did not believe that the chicory had been added for the purpose of fraudulently increasing the bulk; and, further, when the inspector asked for Say's coffee, he was told they had not got any, and was shown a tin of Franck's prize medal coffee, and he said "I'll take it." This Franck's coffee was put up in tins and sold as "prepared" coffee, the label on each tin stating that it was an admixture; and this was put before the inspector, and he said "I'll take this." The fact of his saying, "I'll take this coffee," particularly mentioning the word "coffee," did not, in his (Mr. Mackinson's) opinion, affect the case. There was not, to his mind, the slightest intention to defraud by the seller, and the summons would be dismissed. Mr. Walker said, in case the Corporation thought it desirable, would the magistrate grant a case for decision in a higher court. Mr. Mackinson intimated his willingness to do so.

Butterine Prosecutions.—Heavy Fines :—

At Worship Street Police Court, Mr. Alfred John Palmer, of 281, Roman Road, Old Ford, and Mr. James Summer, of 240, Roman Road, Old Ford, buttermen and cheesemongers, appeared to summonses taken out by the sanitary authorities of the parish of St. Mary, Stratford, for selling as butter an article not of the nature and quality demanded. Mr. Summer, whose defence was that the public knew they could not have butter at 1s. 2d. per lb , and that he was not at the shop himself, said he should appeal. Mr. Hannay inflicted a fine of £20 on Mr. Summer, and on Mr. Palmer one of £5, also ordering each defendant to pay 23s. costs.

Selling Chicory and Coffee without a Label.—Conviction :—

William Morley, provision dealer, of Higher Hillgate, Stockport, was charged before the magistrates in that town, with selling adulterated coffee Mr. Thompson (from the office of the Town Clerk) prosecuted. It appeared that Mr. Jacob Marshall, one of the borough sanitary officers, purchased at the defendant's shop half a pound of ground coffee, for which he paid 7d., the article being supplied by the defendant's wife. The certificate of the Public Analyst showed that the sample contained 52·4 per cent. of chicory. Defendant said he had only recently begun in business, and both himself and his wife were ignorant in these matters. He bought most of the mixture just as it was—certainly he mixed a little himself, and was not aware that he was obliged to put a label on it. They sold it at 1s. 2d. per lb., which, as the Bench would be aware, was not enough for pure coffee. The presiding magistrate, Mr. W. Rayner, M.D., observed that it was a great fraud upon the public to sell an article of food like that—more than one-half chicory. Defendant was fined 40s. and costs.

Butterine Prosecutions at Liverpool :—

At the Liverpool Police Court, on Wednesday, before Mr. Raffles, stipendiary magistrate, James Burke, provision dealer, 40, Everton Road, was summoned for an offence against the Sale of Food Act, by having sold butterine as butter. Evidence was given by a person who visited defendant's shop and asked for a pound of shilling butter, which he received and paid for. A sample of the article was sent to Dr. Campbell Brown, City Analyst, whose certificate, which was put in, showed that it was butterine. The defendant said the article sold was labelled butterine, but the magistrate held that this was not sufficient, and inflicted a fine of 20s. and costs.—Henry Anderton, provision dealer, 26, St. James's Street, was convicted of a similar offence, and was fined in the same amount.

Important Case under the New Act :—

At Clerkenwell Police Court, on January 13th, George Locker, of Eggerton, near Burton-on-Trent, was summoned for having, on the 15th of December last, consigned a can of milk to the Dairy Supply Company, Limited, which, on analysis, was found to be adulterated with 13 per cent. of water. From the evidence of Inspector Rouch, it appeared that on the day in question he met the milk upon arrival, and took a sample from a can sent up by the defendant. This sample he handed to the analyst for the parish of St. Pancras, who certified to the above-mentioned adulteration. The defendant denied any knowledge of the addition of water, and stated that he was prevented attending to the milk personally at the time, owing to a domestic bereavement. Under the circumstances, Mr. Ricketts, who prosecutes for the Vestry of St. Pancras, said he would not press for a heavy penalty, and the Magistrate fined Locker in the mitigated penalty of £5 and £1 5s. 8d. costs.

"Simpson" Severely Punished :—

At Belper Sessions, John Simpson, of Hazlewood, farmer, was summoned by Captain Sandys for selling adulterated milk at Hazlewood, on the 22nd November. The milk was consigned to London. James Slack purchased a pint of milk, which, on being analysed, was found to contain 28 per cent. of water. Defendant pleaded guilty. The chairman said it was a very bad case, the milk containing nearly one-third water. Defendant was fined £10 and costs.

At Wandsworth, Mr. Corsellis, clerk of the Wandsworth Board of Works, attended in support of two summonses against Joseph Saunders and William Gabbett, both grocers, of Nine Elms, for selling to the inspector milk adulterated with water. In each case the sample contained 20 per cent. of water. Both defendants stated that they sold the milk as they received it. Mr. Shiel imposed a penalty of 20s. and 2s. costs in each case.

Analysis of Milk supplied to Public Buildings:—

At the Northern Divisional Police Court, Dublin, Patrick Walsh, dairykeeper, of Lower Summerhill was charged with having sold milk not of the nature and substance of the article demanded. David Toler, food and drug inspector, said that on November 17, he found Thomas Walsh delivering new milk at the Military Prison, Arbour Hill, and purchased a halfpennyworth, telling him it was for the purpose of analysis. The man wanted to know "was that a new dodge,—inspectors going to public buildings? if it were, there would be no dairymen left in Dublin." He delivered the milk to Dr. Cameron, who certified that it contained 14·3 per cent. of water. Mr. Ennis asked that the case should be dismissed, as Thomas Walsh, the seller of the milk, had not been connected in any way with the defendant. The magistrate accordingly dismissed the case.

James Dunne, of Upper Abbey Street, was also fined £3, Dr. Cameron having certified for 21 per cent. of water. It transpired that the accused had been previously fined for a similar offence; but the Law Officer of the Corporation stated that the law did not provide a penalty for previous convictions.

ADULTERATION OF SOAPS.

CONSUMERS of soap, says a writer in the *Deutsche Industrie Zeitung*, should not neglect to inform themselves of the absence of intentional adulterations. A very old trick is to increase the weight of soap with water, but as ordinary soap soon loses this by evaporation in the air, this deception will not succeed unless the soap is sold off quickly. There are two other methods of overweighing. One consists in putting in chemicals that are adapted to hold this excess of water in the soap, so that it loses little or nothing in weight by lying. Another way is to add some mineral substances, soluble or insoluble, to increase the weight and diminish proportionally the value of the soap.

When large consumers neglect to submit their soap to an examination they may suffer considerable loss. There is soap in the market that contains 75 per cent. water, and externally cannot be distinguished from soap that contains only 12 per cent.

Gelatinous substances are most frequently used to retain the water in soap, and at the same time an excellent filling. Alumina in the hydrated form performs this service best. The author detected this substance in six samples of soap, which had over 60 per cent. water, and were sold by their manufacturers at the same price as another manufacturer sold soap with 24 per cent. Other gelatinous substances, like silica and organic substances, are used. They are easily detected by chipping up the soap and dissolving it in alcohol, in which they are insoluble, while pure soap is perfectly soluble. The undissolved residue may be filtered out and more carefully examined. Hot water will dissolve the gelatinous substances if they are organic, like gelatine or glue, leaving alumina, silica, &c., unaffected. By evaporating the aqueous solution and weighing the residue, the quantity of gelatine can be quantitatively determined. The silica and alumina can be dried, then ignited in a platinum or porcelain crucible, and weighed.

Waterglass is frequently added to soap, and, although it is not an injurious ingredient, such soap can be made cheaper, and should be sold as waterglass soap.

In some samples the author found starch, gypsum, chalk, clay, phosphate of lime (bone ash), and barytes, or blanc fixe, as the adulterants. All these can be separated by dissolving the dry soap in alcohol. The alcoholic solution may be evaporated to dryness, dried at 212° Fah., and weighed.

The author found more adulteration in the Berlin soaps than any other; but in the little city of Munster, out of 12 samples from different factories, 5 were adulterated.

The author neglects to mention the fact that impure fats in a state of incipient decomposition are often employed, perfume being added to disguise the odour.

The *Cowkeeper and Dairyman's Journal* says:—"A defendant, rejoicing in the appropriate name of Simpson, has been fined by the Belper magistrates for having too liberally diluted a large quantity of milk intended for the London market. Though the water supply of the metropolis is by no means adequate to the requirements of the population, yet it is not at all desirable that water should be sent to us in milk cans from Derbyshire. We are glad, therefore, that Mr. Simpson has to pay heavily for his attempt to do a service in this respect. The milk which he proposed to pass off upon the confiding public of the metropolis as a genuine bovine extract was proved on analysis to contain 28 per cent. of water. He had no defence to make for having thus attempted to cheat his customers, and accordingly pleaded guilty to the offence with which he was charged. Considering that the London purveyors of milk add plenty of water to it after it arrives here, the dairy farmers who send it up from the country should be all the more careful to despatch it in an unadulterated condition. We trust that other enterprising dairymen of the 'Simpson' class will take warning from the treatment he has deservedly received at the hands of the administrators of justice at Belper."

Mr. William Morgan, Ph.D., of Swansea, has been appointed Public Analyst for the town and county of Haverfordwest.

ERRATUM.—On page 7 of our last number, line four, "Proposed Draft of a National Act," should have been "*Abstract of Proposed Draft*," &c., as only the principal clauses are there set out.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
1921	C. Humfrey	Decomposition of Certain Salts of Soda and Potash	2d.
2214	C. M. Warren	Distillation of Anthracene	4d.
2227	P. Spence	Purifying Sewage	4d.
2236	S. Cohné	Electric Lamp	2d.
2244	W. Clark	Manufacture of an Extract of Fish	2d.
2252	G. G. André	Electric Lamps	6d.
2257	S. Simmons	Preventing Alterations in Cheques	2d.
2259	C. Wigg	Manufacture of Alkalies	6d.
2417	R. S. Newall	Apparatus for Effecting Chemical Decomposition	6d.
2458	G. Best	Apparatus for Purifying and Softening Water	6d.
2497	W. R. Lake	Manufacture of Vanillin	4d.
2322	J. B. Freeman	Manufacture of Varnishes	4d.
2323	J. Storer	Effecting Oxidation, &c., by Interaction of Gases or Vapours with Liquids, &c.	6d.
2395	H. A. Dufrené	Preserving Meat	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane.

THE ANALYST

MARCH, 1881.

SOCIETY OF PUBLIC ANALYSTS.

An Extraordinary General Meeting was held on the 16th February last, at Burlington House, Piccadilly.

Mr. Heisch, on taking the chair for the first time as President, thanked the Members for the honour they had done him in electing him to that position, and apologized for his absence at the Annual Meeting on account of being snowed up at Croydon, and the telegraph wires being also broken he could not communicate with the Secretary.

The Requisition for the Meeting having been read, Dr. Bartlett proposed, Dr. Tripe seconded, and it was unanimously resolved that the following be an additional Rule of the Society:—"That in the event of the resignation or death of any Officer, or of the voting by ballot for the election of an Officer of the Society resulting in an equality of votes, it shall be in the power of the Council to declare the office vacant, and to fill it up for the remainder of the current year, at their first Meeting after the date of such occurrence."

An ordinary General Meeting was then held.

The minutes of the Meeting having been read, were confirmed.

Dr. Bartlett and Mr. Maxwell Lyte having been appointed Scrutineers, opened the ballot papers, and reported that the following gentlemen were duly elected Members of the Society:—Thomas Stevenson, M.D , F.C.S., F.I.C., of Guy's Hospital, Public Analyst for Bedfordshire, Surrey, &c.; Horace Swete, M.D., F.C.S., Public Analyst for Worcester, &c.; W. Douglass Hogg, M.D., F.S.P., Chemist, of Paris; P. Vieth, Ph.D., F.C.S., Analytical Chemist; H. J. Yeld, M.D., F.C.S., Public Analyst for Sunderland; W. Johnstone, F.C.S., F.I.C., Public Analyst for King's Lynn; J. J. Broadbent, F.C.S., Analytical Chemist, of Charing Cross Hospital.

Letters were read from Prof. Fresenius and Dr. Hoffman accepting the Honorary Membership of the Society, and were ordered to be entered on the minutes.

The following were proposed for election and will be balloted for at the March Meeting. As Members—W. D. Sykes, M.D., Public Analyst for Portsmouth; John Parry, Public Analyst for Penryn; Henry Liepmann, Ph.D., F.C.S., Analytical Chemist, Leadenhall Street, London. As Associates—W. Fox, Assistant to Mr. J. Baynes, of Hull, and D. A. Sutherland, Assistant to Dr. Drinkwater, of Edinburgh.

The following papers were then read:—"On a Simple and Expeditious Process for Determining Nitrates and Nitrites in Water Analysis," by M. Whitley Williams.

"On the Action of Permanganate on Potable Waters at Different Temperatures,' by G. W. Wigner and R. H. Harland.

The next meeting of the Society will be held at Burlington House on Wednesday, the 16th March.

A SIMPLE AND EXPEDITIOUS PROCESS FOR THE ESTIMATION OF NITRIC ACID IN WATER ANALYSIS, WITH SOME REMARKS ON THE ESTIMATION OF NITROUS ACID.

By M. Whitley Williams, F.I.C., F.C.S., formerly Chemical Assistant in the Royal Institution of Great Britain.

Read before the Society of Public Analysts on 16th February, 1881.

It is well known that when zinc is immersed in copper sulphate solution it becomes covered with a spongy deposit of precipitated copper. If the solution of copper sulphate be sufficiently dilute, this deposit of copper is black in colour and firmly adherent to the zinc. It is, however, not so generally known that the zinc upon which copper has thus been deposited possesses the power of decomposing pure distilled water at the ordinary temperature, and that it is capable of effecting many other decompositions which zinc alone cannot. Among these is the decomposition of nitrates, and the transformation of the nitric acid into ammonia. Messrs. Gladstone and Tribe have shown that the action of the "copper-zinc couple" (as they call the conjoined metals) upon a nitre solution consists in the electrolysis of the nitre, resulting in the liberation of hydrogen and the formation of oxide of zinc. This hydrogen is liberated upon and occluded by the spongy copper, and when thus occluded it is capable of reducing the nitre solution in its vicinity. The nitrate is first reduced to nitrite of potassium, and the nitrous acid is subsequently transformed into ammonia by the further action of the hydrogen. In a paper lately read before the Chemical Society I have shown that even in very dilute solutions of nitre the nitric acid can be completely converted into ammonia in this manner with considerable rapidity; and I have further shown that the reaction may be greatly hastened by taking advantage of the influence of temperature, acids, and certain neutral salts which increase the electrolytic action of the couple. I there showed that carbonic acid—feeble acid as it is—suffices to treble the speed of the reaction, and that traces of sodium chloride (0·1 per cent.) accelerated it nearly as much as carbonic acid. A rise of a few degrees in temperature was also found to hasten the reaction in a very marked degree. The presence of alkalies, alkaline earths, and salts having an alkaline reaction, was found to retard the speed of the reduction.

Upon those experiments I founded a simple and expeditious process for estimating the nitric and nitrous acid in water analysis, which, when used with skill, may be applied to by far the greater number of waters with which the analyst is usually called upon to deal. Before describing this process I will first say a few words upon the nature and use of the copper-zinc couple, about which considerable misapprehension appears to exist even in the best informed quarters. This appears very plainly from the description of the copper-zinc couple process given in the *Handbook of Water Analysis*, recently published by Frankland, in which mistaken directions are given for making the couple and applying it to the estimation of nitric acid in water analysis. There are two kinds of copper-zinc, one (the "dry couple") intended for anhydrous reactions, the other (the "wet couple") intended for hydrogenizations in watery or alcoholic solutions. These two are quite different reagents, differently prepared and different in their application. It is the "wet couple" alone which is adapted to hydrogenizations, such as the transformation of nitric acid into ammonia; but in the handbook referred to, the dry couple is described as being used for effecting this transformation, a purpose to which I believe it has never been applied, and for which it would certainly be very inefficient.

The wet couple, with which alone we have now to deal, is prepared in the following manner:—The zinc to be employed should be clean, and for the sake of convenience should be in the form of foil or very thin sheet. It should be introduced into a flask or bottle, and covered with a solution of copper sulphate, containing about 3 per cent. of the crystallized salt, which should be allowed to remain upon it until a copious firmly adherent coating of black copper has been deposited. This deposition should not be pushed too far, or the copper will be so easily detached that the couple cannot be washed without impairing its activity. When sufficient copper has been deposited the solution should be poured off, and the conjoined metals washed with distilled water. The wet couple is then ready for use.

To use this couple for the estimation of nitrates, in the manner I am about to describe, it should be made in a wide-mouthed stoppered bottle. After washing it is, of course, soaked with distilled water; to displace this, it is first washed with some of the water to be analysed, and the bottle filled up with a further quantity of the water. The stopper is then inserted, and the bottle allowed to digest in a warm place for a few hours. If the bottle be well filled and stoppered, the temperature may be raised to 30° C., or even higher, without any fear of losing ammonia. The reaction will then proceed very rapidly; but if it be desired to hasten the reaction still more, a little salt should be added (about 0·1 grm. to every 100 c.c.), or if there be any objection to this, the water may have carbonic acid passed through it for a few minutes before it is poured upon the couple. In the case of calcareous waters, the same hastening effect may be obtained, and the lime may at the same time be removed by adding a very little pure oxalic acid to the water before digesting it upon the couple. In my paper communicated to the Chemical Society I showed that nitrous acid always remained in the solution until the reaction was finished. By testing for nitrous acid the completeness of the reaction may be ascertained with certainty, and perhaps the most delicate test for nitrous acid that can be applied for this purpose is that of Peter Griess, in which metaphenylene diamine is the reagent employed. When a solution of this substance is added to a portion of the fluid, and acidified with sulphuric acid, a yellow colouration is produced in about half-an-hour if the least trace of a nitrite be present. The reaction easily detects one part of nitrous acid in ten millions of water. When no nitrous acid is found, the water is poured off the couple into a stoppered bottle, and, if turbid, allowed to subside. A portion of the clear fluid, more or less according to the concentration of the nitrates in the water, is put into a Nessler glass, diluted if necessary, and titrated with Nessler's reagent in the ordinary way.

This process may be used for the majority of ordinary waters—for those that are coloured, and those that contain magnesium or other substances sufficient to interfere with the Nessler reagent, a portion of the fluid poured off the couple should be put into a small retort and distilled with a little pure lime or sodium carbonate, and the titration of the ammonia performed upon the distillates.

About one square decimetre of zinc should be used for every 200 c.c. of a water containing five parts or less of nitric acid in 100,000. A larger proportion should be used with waters richer in nitrates. The couple, after washing, may be used for two or three waters more. When either carbonic or oxalic or any other acid has been added to the water, a larger proportion of Nessler reagent should be employed in titrating it than it is usual to add. I have found 8 c.c. to 100 of the water sufficient in almost all cases.

In calculating the amount of nitric acid contained in a water from the amount of ammonia obtained in this process, deductions must of course be made for any ammonia pre-existing in the water, as well as for that derived from any nitrous acid present.

To ascertain the amount of nitrous acid in a water, Griess's latest method should be adopted. A one-half per cent. solution of metaphenylene diamine in very dilute sulphuric acid should be prepared, and a dilute sulphuric acid containing one volume of oil of vitriol to two volumes of water. One c.c. of each of these solutions are added to 100 c.c. of the water in a Nessler glass, and the yellow colouration produced (if any) is imitated by means of a standard solution of potassium nitrite with the same reagents. This standard solution is prepared from silver nitrite, prepared by precipitation, and re-crystallized from boiling water. A weighed amount of this pure dry silver nitrite is dissolved in boiling water, decomposed with a slight excess of potassium chloride, and diluted to a convenient strength. The solution I usually employ contains ·01 of a milligramme of NO_2 in 1 c.c. A solution of ten times this strength is kept in stock in bottles quite filled and tightly stoppered, and is diluted when required for use. To ensure accurate results the solutions to be compared should be simultaneously started and allowed to stand at least twenty minutes before their tints are compared. They should be at the same temperature, for I have observed that the colouration is developed much more rapidly in warm than in cold solutions. There are other conditions which affect the rate of development of the colouration, but these appear to be of a chemical nature and not easily controlled. In these cases only the final tints of the solution should be regarded. The lengthy time required for the full development of the colour, renders it difficult or at least laborious to prepare a solution of exactly the same tint as that under analysis, and it is therefore desirable to adopt some method of making the titration, which, while sufficiently accurate, shall dispense with the necessity for making a long series of trials. I have usually effected this with the aid of Nessler glasses made from pieces of stout glass tubing, about 30 mm. bore and 200 mm. long, ground at the edges and closed at one end with a glass plate cemented on with Canada balsam. The tubes are of exactly equal bore and are graduated from end to end in millimetres. They are used in the following manner: The solution to be titrated and the test solution are made in the usual way, both columns of fluid being of equal length. The test solution is made as nearly as can be guessed to equal in tint that to be titrated. Usually one will be somewhat deeper than the other; the height of the deeper solution is read off upon the millimetre scale, and a portion of it withdrawn by means of a pipette until the shortened column is equal in tint to the other, when its height is again read off. The amount of nitrite in the shortened column is taken as being equal to that in the other glass, and a simple proportion will give the amount of nitrous acid contained in the solution titrated. In this way the titration can be made very expeditiously.

The metaphenylene diamine solution should be decolourized with animal charcoal whenever necessary.

Dr. Dupré said he was very glad that Mr. Williams had given them the paper and hoped it would be the forerunner of other papers from other chemists who were not actually members of the Society. With regard to the estimation of nitric acid he had the strongest evidence that the indigo process was absolutely useless when certain kinds of organic matter were present. He was certainly not prepared for its absolute failure, but there was no doubt about it, and they must go to another method. He was very favourably impressed with that described by Mr. Williams, and although it might take a longer time than the indigo process for a single water, yet if a number were to be examined it did not much matter, as after starting the waters something else could be gone on with; thus the actual work did not take more time than the indigo process, and in many cases would give accurate results where the indigo process would not. He could certainly speak very strongly of the failure of the indigo method in certain waters, and the probability was that it broke down in nearly every case. It broke down entirely in the presence of urine in water, and almost entirely with albumen in water. It was only an approximate method at best.

[Preliminary Note.]

ON THE ACTION OF PERMANGANATE ON POTABLE WATERS AT DIFFERENT TEMPERATURES.

By G. W. Wigner, F.C.S., F.I.C., and R. H. Harland, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 16th February, 1881.

The criticism to which the series of water analyses now being published by the Society of Public Analysts will be subjected, renders it especially necessary that every detail of the processes used should be placed on such a basis that as far as possible comparison may be made with what has been previously done.

In the case of oxygen absorbed from permanganate of potash, the instructions issued to the analysts have made in two respects a distinctly new departure, viz., the time during which the permanganate is allowed to act, has been increased from three hours, which has hitherto been the general custom, to four hours, and the temperature at which the action takes place has been increased from the 60° adopted by many analysts, or the so-called "normal" temperature adopted by others to a definite standard temperature of 80° F.

Both of these changes have the effect of increasing the amount of oxygen absorbed, but there appear to be no data on record to show what the amount of this increase is. We have therefore made a series of experiments on two water supplies, one being from deep chalk wells and the other a river water, and on one of them after admixture with a definite proportion of urine, and on another portion of the same water after admixture with a definite proportion of raw sugar, thus making four different waters, two of which were purposely contaminated.

We have treated each of these four samples with permanganate by the addition of 100 grains, or, if necessary, more, of the standard solution (each water grain of which corresponds to ·0001 grain of available oxygen) to 1-20th gallon of the water, and titrated the solution back after treatment with hyposulphite of soda in the usual way. This experiment has been made in each case at the different temperatures of 60°, 80°, 90° and 100° F., and at each temperature the water has been allowed to stand for one hour, two hours, four hours and six hours.

From this we get two series of figures, one showing the increase in the amount of oxygen absorbed by waters of different degrees of purity, according to the length of time that they remain in contact with the permanganate, and another showing the amount absorbed by the same water, standing for the same time, but at different temperatures from 60° to 100°.

All these results have been obtained in flasks, closed at the top by a glass marble while the action was going on, and the hyposulphite has been titrated with permanganate afresh each day in distilled water.

Another series of experiments, conducted in open beakers, in which specially pure distilled water was in every case worked side by side with the samples, and after standing the full time titrated as a standard, gave results as nearly accordant as may be when the correction found by the distilled water was applied. It will not do, however, to work in this way without this correction.

In one experiment with a sample of water treated with permanganate at a temperature of 70° for three hours, the oxygen actually absorbed in a covered beaker was ·016, and that in an uncovered beaker ·032. In another experiment on a different sample the amount of oxygen actually absorbed in a covered beaker was ·004, and in an uncovered beaker ·028. But the error in each case was always perfectly eliminated by the correction due to the titration of the diluted water standing for the same time.

Taking the chalk water, it will be noticed that the amount of oxygen absorbed in six hours is, speaking in general terms, from three to six times as much as that absorbed in one hour. But the influence of the longer time is shown much more strongly at low temperature than at 100° F.

In the case of the river water the increase of time has not had nearly so much influence.

RESULTS OF EXPERIMENTS WITH PERMANGANATE OF POTASH ON WATERS AND POLLUTED WATERS AT DIFFERENT TEMPERATURES AND FOR DIFFERENT TIMES.

Temp.	Deep Chalk Well Water.				River Water.				River Water, with 200 Grains Raw Sugar added per Gallon.				River Water, with 200 Grains Urine added per Gallon.			
	1 hour.	2 hours.	4 hours.	6 hours.	1 hour.	2 hours.	4 hours	6 hours	1 hour.	2 hours.	4 hours.	6 hours.	1 hour.	2 hours.	4 hours.	6 hours.
60°	·002	·006	·012	·018	·064	·072	·080	·086	·078	·104	·130	·160	·350	·390	·420	·478
80°	·006	·010	·016	·024	·070	·076	·088	·110	·094	·112	·192	·280	·388	·400	·476	·520
90°	·010	·014	·020	·028	·076	·081	·104	·118	·110	·174	·292	·486	·400	·476	·524	·618
100°	·012	·016	·020	·030	·084	·090	·110	·126	·112	·260	·544	·944	·460	·520	·584	·674

The difference between the oxygen absorbed at 60° being only about one-third, and at 100° only about one-half.

Taking the case of the sample polluted with urine, the difference between the one hour and six hours determinations is almost the same as in the river water alone, while in the case of the same polluted with sugar the increased action is very much greater, varying from about two-fold to eight-fold.

In the same way the increase of temperature appears to tell on the chalk water in the proportion of something like a two-fold absorption of oxygen at 100° as compared with that at 60°. In the case of the river water about half as much more oxygen is absorbed at the higher temperature as at the lower. The water contaminated with urine shows a slightly higher increase with a higher temperature, while in the case of the water admixed with sugar the increased amount absorbed at the higher temperature is remarkably variable. In one hour the 40° of increased temperature only shows some 40 per cent. increase in absorption; two hours shows an increase of some 250 per cent.; four hours shows some 420 per cent. increase; and six hours nearly 600 per cent.

From these results it is clear that further experiments on waters containing sewage in active decomposition, and on river water in various degrees of purity, and with varying oxidation after contamination, are necessary before we can definitely decide what influence temperature has on this most important reaction.

We have already made some other large series of experiments on the matter in flasks with a water seal, but the experiments are not complete enough to lay before the Society yet.

A PROCESS FOR THE INDIRECT VOLUMETRIC ESTIMATION OF GLYCERIN.

By John Muter, Ph.D., F.I.C.

I have been for some time engaged in an attempt to apply the power of glycerin in arresting the precipitation of cupric hydrate by potassium hydrate to its volumetric estimation. So far as I can discover, no process of the kind has ever yet been proposed for quantitative purposes, and an even fairly accurate method for rapidly estimating glycerin in commercial solutions of it, and in the ley from the saponification of fats, is not in existence. My experiments, although unfinished, give such good hope that the difficulties now met with may be overcome, that I think it advisable to mention the matter as it now stands. At present I can only give the process and its results, as tried on known solutions of pure glycerin, my research into the best methods of separating it from the bodies acting similarly on copper being still incomplete, but such will I hope soon follow, and then the whole will be perfect. Meantime, even a good approximate process to within a per cent. is at least a desirable advance. A great difficulty in getting reliable results, lies in obtaining for such experiments truly absolute glycerin, and although that which I used was supposed to be so, and agreed with the stated specific gravity, still, I do not pretend as yet to lay down the actual power upon copper in figures, but content myself with doing a check analysis with so-called absolute glycerin each time I standardize my solutions. It will be seen from the subjoined figures, taken at random from a mass of analyses, and showing both the best and the worst results obtained by this method, that the process even now works fairly well:—

Glycerin taken.	Glycerin found.
1·000	·985
·905	·922
·900	·905
·500	·498
·505	·502
·504	·501
·250	·248
·251	·254
·252	·249

The first and second results are the worst I ever had, and were obtained at the commencement of the work, while the others represent the later trials; after experience and employing pure cyanide, they begin to come out very close to the truth.

The process is as follows: Take one gramme of absolute glycerin, and wash it into a long stoppered graduated tube, having a stopcock at 50 c.c. from the bottom. This tube is the same as that used in my process for the rapid estimation of olein in fats (as described and figured in The Analyst, vol. ii., page 74, and can be obtained from Messrs. Orme & Co., Barbican, E.C., who sell them as "Muter's Olein Tubes"). Now add 50 c.c. of a strong solution of potassium hydrate (1 in 2), and then a weak solution of cupric sulphate very gradually and with constant shaking, until a fair amount of cupric hydrate is produced which remains undissolved. Make the whole up to a given bulk, and then close the tube and set it aside to settle. When perfectly clear, run off from the tap into a beaker a given volume of the deep blue liquid, and add to it the slightest possible excess of nitric acid; then pour in a definite excess of ammonium hydrate, bring the beaker under the burette charged with volumetric solution of potassium cyanide, and run in till decolourized. The number of c.c. of potassium cyanide used, after calculating to the whole bulk originally in the tube, represents one gramme of glycerin. This result has, however, to be corrected by going through the blank experiment with the same amounts of everything, *but without glycerin*, and deducting the c.c. of cyanide taken from that before found; this is necessary, because cupric hydrate is not quite insoluble in the strong alkali used, but once made and deducted, the difference gives the true value in glycerin of the cyanide solution, and that once standardized, any number of samples can be quickly analysed. I now use absolutely pure potassium cyanide, made from hydrocyanic acid, which I obtain from Germany, together with the absolute glycerin, through the agents of the firm, Messrs. Burgoyne, of Coleman Street, E.C. The source of the small error still apparent lies perhaps to some little extent in not making allowance for the space occupied by the precipitated cupric hydrate, but more especially in the inherent difficulty of working the cyanide estimation of copper to a perfectly constant point. I intend to try Bernsthen's method of titration with sodium hydrosulphite in an atmosphere of hydrogen, with indigo as an indicator, in the hope that it may prove better, but meantime the process can claim to be as accurate as the ordinary cyanide estimation of copper will permit. I am engaged in a re-analysis of butter and other solid fats, with the view of proving, by the aid of this method, whether they are all really triglycerides or not, and hope soon to lay the results before the Society. In minute operations like these, I estimate the copper by electrolysis on platinum, which gives the required accuracy.

I may also mention that I am now trying whether better results cannot be obtained by titrating the glycerin-copper solution with pure glucose, or by using excess of glucose, igniting the precipitate with hydrogen, and weighing as metallic copper.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

We publish in this number the second series of reports on the public water supplies of England, and we are able to include this month a report on the supply of Edinburgh as a first instalment towards monthly reports on Scotch and Irish towns as well. It will be seen that with one exception—Nottingham—we now include analyses of the supplies of every one of the 20 large towns comprised in the Registrar-General's weekly reports, and we hope our next table will contain this one missing place.

As we anticipated in our last issue would be the case, this systematic and uniform series of analyses has excited much interest not only among the authorities of the towns whose supplies have actually been reported upon, but in those of many other towns, some of whom knowing the character of their supplies to be good, were anxious to be included in the scheme, while others, doubtful as to the character of their water, naturally desired to be exempted from it.

We are also enabled in our present issue to give descriptions of the sources of supply and method of filtration (if any) employed in 20 towns not included in the previous report, making a total of 34 reports of this kind published up to this date, and we hope to complete these in our next number by giving similar details with regard to all the other towns.

It is far too early to attempt to go into any detailed examination of the variations which are taking place in the different waters, but one fact is evident to the Water Committee who have examined these reports previous to publication, viz.: that, taking the whole of the supplies the country through, the character of the water supplied in February to the towns reported upon, was almost uniformly worse than that supplied in January. Probably the cause of this may be attributed in some degree to the exceptionally heavy fall of snow which occurred in the latter part of January, and which appears in a large number of cases to have increased the mechanical impurities as well as the dissolved impurities in the waters.

Another advantage which has accrued from this publication has been the determination on the part of a number of analysts to report waters which are sent to them for personal examination and analysis, precisely in the same form that has been adopted by the Water Committee. Such a step must be an immense advantage to the profession at large by ensuring a means of making a fair comparison between analyses made at different times by different analysts, as it is notorious that hitherto there has been no analysis in which such varied forms of reports have been used as in the case of water.

Two more papers on Water Analysis are published in our present number, one of which gives another alternative method for the estimation of nitrates in potable water, which may fairly be submitted to a comparative test as against the three methods already sanctioned by the Committee as a temporary arrangement. This comparison will show whether it possesses any advantages which would entitle it to be used at the expiration of the term of six months as *the* method to be finally adopted.

The offer to send copies of the "Instructions to Analysts" to those interested, has been taken advantage of so extensively, that it has been necessary to issue a second edition with slight emendations and additions, and the Secretary of the Society of Public Analysts will, as before, be pleased on receipt of a stamped envelope to send a copy to anyone who may desire it.

The difference between the analysis of the Kent supply in January and that published in this number is accounted for by the fact that the sample has come principally, if not entirely, from a different well. We hope next month to be able to print the analyses of the water taken simultaneously from all the different wells of this company.

The analysis given under the heading "Trafalgar Square Well Water" is from the Artesian well in that square used to supply the fountains, and a small portion of which is, we are informed, also used for drinking purposes.

PROVINCIAL TOWNS.

Bradford.—The supply is obtained from three sources—1, The moors above Oxenhope (high level); 2, Springs at Chellow Dean (intermediate level); 3, Reservoirs at Barden and Chelker (low level). The total capacity of the reservoirs is 1,154,000,000 gallons, and the daily consumption 7½ to 8 million gallons. The geological formation of the sites of the reservoirs is the carboniferous, peat, clay, millstone grits, and shales, with a few beds of coal. The water, although slightly coloured with peat, is very soft and good.

Birmingham.—The sources of supply of this water are of two kinds—first, from certain streams outside the town, viz., the river Bourne, the Perry and Witten and Plants brooks; and, second, several deep wells sunk into the red sandstone. The waters from these two very different sources are mixed in reservoirs before distribution, and the portion derived from streams is submitted to filtration more or less perfect.

Bristol.—The Company commence to take their supply from the Chew Hill Head Spring on the Mendip Hills, about 16 miles from Bristol and 430 feet above the Bristol Floating Harbour. From this point the "line of works" passes through the parishes of Litton, East and West Harptree, Chew Stoke, and Winford, with about ten miles of iron tubes and tunnel driven as much as 170 feet from the surface of the ground. Some deep-seated springs are taken up *en route.* At the Winford end of the tunnel the water is discharged into the store reservoirs at Barrow Gurney, about 4½ miles from Bristol, 300 feet above the Floating Harbour. At Barrow Gurney rises the Cold Bath Spring, which is also taken. These constitute the gravitation sources of supply. Water is also obtained, when required, by pumping from deep wells at Chelvey, near Nailsea, about nine miles from Bristol.

Derby.—The supply is derived partly from springs in the millstone grit at Little Eaton and Cocksbench, and partly from two 9 ft. culverts, which run along for some miles on either side of the Derwent, at a distance of 21 feet from the river, and below the level of the river bed. These culverts are built of bricks without mortar, about 4 inches thick, and are immediately surrounded by several feet of coarse gravel. They are filled with water from the hills on either side of the river. The waterworks are at Little Eaton, some two and a-half miles from the town, and here the culverts are connected by two 24-inch iron pipes which pass under the river. The water rises in two wells and flows into a reservoir at the works, which also receives the water from the springs. It is pumped up thence into filtering beds consisting of 18 inches fine sand, 1 foot fine gravel, 1 foot coarse gravel, 18 inches boulderstones, 18 inches rough sandstone, and falls by gravitation into the town. The supply is about 1¼ million gallons daily, of which about 900,000 gallons are derived from the springs at Little Eaton and Cocksbench.

Droitwich.—This water has been supplied to the town within the last two years, all water being previously saline. Prospecting for water a hill of gravel and pebbles (a glacial drift) was found measuring 4 miles by ½ mile, and containing water the chlorine in which did not exceed 3 grains per gallon. Round the area the chlorine ranged from 12 to 72 grains. Borings were made which gave a good water. Mr. Prichard, C.E., put in numerous star adits, with large stoneware pipes pierced with holes as at Warwick. 60,000 gallons per day are delivered, being pumped up from a reservoir, into which the adits fall, to a covered tank 100 feet above the level, and then delivered to the town by gravitation. The water is generally very pure, but the late snows and heavy floods have evidently polluted it, falling into the adits at a lower level. A few feet below the adits the water is saline.

Grantham.—The water is derived from the Oolite limestones to the south of the town. A portion comes from springs and headings in the water-bearing strata at Stroxton, about three miles from the town. This is delivered by gravitation through iron pipes to the service reservoir. The larger portion is collected from various springs at Little Ponton, extending to a distance of two miles from the town; and conducted by an iron main to a reservoir at the pumping station whence it is pumped up to the service reservoir. Some water was formerly taken from the Stoke River, a tributary of the Witham, and from a spring at Great Ponton. Both these sources of supply were objectionable, the river water not only being very turbid after rain, but being also polluted with sewage above the intake, and the spring being subject to surface pollution. The supply was much improved last year by ceasing to take water from the last two named sources, and by increasing the size of the collecting main from Little Ponton, whereby the yield of pure spring water is greatly augmented. The service reservoir is 133 feet 6 inches above the level of the centre of the town. It is covered over and has a capacity of 678,600 gallons. The water is delivered to the town on the constant system. The works belong to a private company formed in 1850. (This supply will only be reported on bi-monthly. See ANALYST for January, page 22.)

Hull.—The supply is from the underlying chalk strata, which stretch for miles all around. The gathering grounds are to the N. and W. of the town. The natural outflows of the underground waters are various springs in the low-lying districts and the broad channel of the Humber. The site of one very copious outflow at Springhead—4 miles west of Hull—was 18 years ago made into a pumping station; shafts and bores were sunk and the supply now exceeds 6,000,000 gallons per day, drawn from a mean depth of 50 feet below the surface. The overplus of the night's pumping is sent into reservoirs at Stoneferry, 8 miles from Springhead, and these supply an extra engine which assists the Springhead engines during the working hours of the day. As the town increases steadily, and the supply in ordinary seasons is very little beyond the demand, new works are now in progress for increasing this supply. An adit or tunnel 4,000 feet long and from 50 to 60 feet below the ground level is under construction. It is intended that new bores at and near the end of this adit shall send additional water to the Springhead pumping shafts. The adit will also form a useful underground reservoir.

Liverpool.—This supply is derived from two distinct sources: viz., from a gathering ground at Rivington, near Chorley, and from deep wells in the red sandstone formation. The water thus obtained is mixed, generally in about the proportion of two parts of Rivington and one part of well water, previous to distribution. The gathering ground at Rivington is partly of a peaty nature, but in other respects is well adapted to the purpose. Of the wells there are four, or counting the Bootle deep borehole, five. Of these the Green Lane Well supplies the greatest quantity. The population supplied is about 700,000—the service being constant.

Llandrindod.—This water is collected in the Radnorshire Hills, and after passing over a large surface of Trap rock, with veins of calcareous spar, is stored in a reservoir, which is cut out of the rock and covered over, from whence the water is distributed to the houses by gravitation.

Newark-on-Trent.—The water is derived from a series of culverts dug in the gravel by the side of the Trent for a distance of fifty yards, about two miles above the town. The water filters through the gravel into the culverts, and is pumped into a covered service reservoir having a capacity of 500,000 gallons, situated on some high ground outside the town. The water is delivered directly from the mains on the constant system.

Plymouth.—This water is derived from the peat bogs on the Dartmoor granite hills, passing through an open seat about twenty miles in length. After heavy storms from the south-west it is frequently much stained with peat, and it also contains salt driven in from the sea. At ordinary times it is very soft, of fair colour, and of good quality, though there is said to be much room for improvement in the filtering arrangements.

Portsmouth.—The water is obtained from copious surface springs which rise from chalk, partially in the parish of Bedhampton and partially in the parish of Havant, eight miles from Portsmouth, from whence it is pumped into reservoirs, the capacity of which is 8,000,000 gallons, on Portsdown Hill, two and half miles from and about 140 feet above the town; from thence it descends by gravitation and is distributed over the district. The supply is constant, and the Company supplies an estimated population of 135,000 people.

Reading.—Reading and its suburbs have a constant service from the works, which are in the hands of the Corporation. The water is derived from the River Kennet. The intakes are about two miles above the town. There are two sets of works pumping by water power with auxiliary steam power at times. The older works pump by water wheels to large reservoirs in the Bath Road, holding about four days supply, filling through filters of small superficial area with twelve feet of water above five feet of gravel, shingle and sharp sand. The water filters too quickly and under pressure. The new works pump by turbines. They have two settling reservoirs and three filters each about thirty yards square. The subsidence is assisted by the water being caused to pass upwards and then over a wall or weir before it enters the filters. The filters have three feet of gravel and sand, with about two feet of water above, so that they filter more slowly and under less pressure than at the older works. None of the filters or reservoirs are covered from the sun, and during flood time the filters require constant cleaning. Both works are used at times. Above Reading there is the town of Newbury not yet sewered, at a distance by the windings of the river of about twenty miles. The river runs through a flat open country, but is liable to floods both winter and summer, when much vegetable and inorganic matter gets washed down.

Rugby.—The water supply is principally derived from the drainage of pasture lands. Advantage being taken of the gradient, the water flows to a settling tank, passes through a filter bed, and is pumped up to a tank on the top of a tower. In dry weather, when the surface supply is short, water is pumped from a reservoir near the river Avon, which is kept filled from a well in the immediate vicinity.

Sevenoaks is supplied with water from a well about 120 feet deep, sunk through Kentish rag into the Folkestone Beds, and about one-third of a mile from the town; but a portion of the water comes from a tunnel close by. The supply is ample, there being sufficient (at 15 gallons per head per day) to supply a town of 35,000 inhabitants. It is pumped from this well into a covered reservoir by Knole Park and near the Tunbridge Road from whence it descends by gravitation to the town. The Company are now building a new concrete reservoir, about 150 feet higher than the present one, to supply the increasing wants of houses built on a higher level. The consumption, during 1880, was less than 14 gallons per head per day, including trade and street watering. (This supply will only be reported on bi-monthly. See ANALYST for January, page 22.)

Stourport.—This water is supplied by the Kidderminster Water Works, and is derived from an Artesian well, shaft 120 feet, then 10-inch borehole 600 feet; and also from another well, 85 feet, with a 10-inch borehole 200 feet deep, from the new red sandstone. The quantity supplied is about two million gallons per diem.

Sunderland.—The water supplied to this borough is obtained from the dolomite or magnesian limestone, by means of shafts sunk to a depth of 46 fathoms, at Ryhope, Seaham, Dalton-le-Dale, Humbledon Hill, Cleadon, and Fulwell, and is in the hands of the Water Company, who, in addition to Sunderland, also supply Ryhope, Seaham, North and South Hylton, Ford, Boldon, South Shields, Jarrow, and Hebburn. The delivery last year was at the rate of 4,593,000 gallons per day. The supply per head of the population of Sunderland—exclusive of that supplied for manufacturing purposes, which average 10 gallons a day—is at the rate of 12 gallons per day, making a total of 22 gallons per head per day supplied for all purposes. The supply is continuous, so that practically there is no limit as to its use.

Whitehaven.—This has a constant water supply, derived from Ennerdale Lake, about nine miles distant from the town. The water is conveyed in iron pipes, coated with Dr. Angus Smith's preparation. It is not filtered. The service reservoir, situated outside the town, is small and uncovered. The substrata of the Ennerdale valley (the source of the supply, consists of clay slate (skiddow slate) highly altered, Ennerdale syenitic granite, and Borrowdale series of volcanic rocks.

Wolverhampton.—The supply is about 2½ million gallons per day, 1½ million gallons of which is derived from the River Worf at Cosford, about nine miles from Wolverhampton and three from Shifnal in Shropshire. The balance of the supply is well water, of which the main portion (say ¾-million gallons) is derived from an Artesian borehole into the new red sandstone at Cosford; but about ¼-million gallons come from the new red sandstone by two other wells, situated respectively at Goldthorn Hill and Tettenhall pumping stations, within a mile or two of the town.

Worcester.—The water is taken from the Severn one mile above the city, passed through filter beds of sand and gravel (which are cleansed weekly), then pumped up to a reservoir on a hill, and supplied by gravitation to dwelling houses. 1,600,000 gallons are pumped daily. The water contains peat and (whitewater) kaolin from the decomposition of feldspathic rocks in Montgomeryshire. The purest water, and largest in quantity, is derived from the river Vyrnwy, which joins the Severn a few miles above Shrewsbury. Pollution of Severn: flannel mills, lead mines, zinc, sewage of Newtown and Welshpool. Pollution of Vyrnwy: peat and kaolin, sewage of Oswestry. Pollution of Severn after junction: sewage of Shrewsbury, Bridgnorth, Stourport, mills refuse of Kidderminster and Stourport, salt refuse of Droitwich. The oxidation of pollution in the Severn is very remarkable, chiefly owing to the admixture of Vyrnwy waters, which partly also dilute the polluted waters. "White Water" cannot be removed by the sand filter beds. At present the town water is not so good as usual, owing to the continued floods.

SOCIETY OF PUBLIC ANALYSTS.

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Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	greenish	v. slight	1·84	none	·8488	none	0087	none	·0340	17·4°	4·5°	30·00	satisfactory	Wigner & Harland.
New River	c. yellow	none	1·05	traces	·2420	·0026	·0028	·0084	·1132	15·1°	4·4°	19·88	none	B. Dyer.
East London ..	greenish	v. slight	1·20	h. traces	·8000	·0014	·0071	·0020	·0760	16·6°	8·0°	21·80	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	yellowish	slight	·99	traces	·1200	·0007	·0112	·0045	·1120	14·0°	7·5°	20·16	satisfactory	J. Muter.
West Middlesex	urine yellow	none	1·026	traces	·1550	·0009	·0078	·0020	·1190	14·2°	3·9°	19·16	amorphous matter	O. Hehner.
Grand Junction	clear	none	1·20	traces	·1477	·0007	·0061	·0078	·0796	14·4°	4·6°	21·00	none	A. Wynter-Blyth.
Lambeth	yellowish	none	·99	traces	·1200	·0022	·0133	·0045	·1282	16·0°	7·0°	21·88	satisfactory	J. Muter.
Chelsea	c. greenh. brown	none	1·06	trace	·1800	none	·0067	·0070	·0714	16·5°	6·0°	21·00		A. Dupré.
Birmingham ..	s.turb. f. grn. ylw	none	1·40	traces	·2160	·0028		·0028	·0470	11·6°	4·9°	18·83	veget. debris, minl. mattr.	A. Hill.
Bradford	f. dirty yellow	none	·75	none	none	·0007	·0077	·0280	·1800	4·3°	3·7°	7·80	amorphous peaty matter	F. M. Rimmington.
Brighton	c. pale green blue	none	2·20	none	·2000	none	·0048	none	none	12·6°	4·2°	24·80	satisfactory	Wigner & Harland.
Bristol	f. brownsh. green	none	·79	trace	·0520	none	·0035	·0043	·0280	16·3°	1·2°	21·40	sand diatoms desmids	F. W. Stoddart.
Cambridge	pale blue	none	1·40	h. traces	·2300	·0035	·0042	·0010	·0108	17·4°	5·0°	25·20	satisfactory	J. West-Knights.
Canterbury	c. pale blue	none	1·47	none	·3380	·0007	·0007	·0040	·0170	7·0°	5·0°	10·92	traces mineral	S. Harvey.
Croydon	slight green	slgt. earthy	1·19	traces	trace	·0070	·0140	none	·0136	15·5°	6·5°	23·00	none	C. Heisch.
Derby	v. good	none	·90	none	·0482	·0010	·0035	none	·0357	13·5°	5·7°	19·60	satisfactory	L. Archbutt.
Droitwich	bluish green	none	2·25	none	·1564	none	·0098	none	·0700	36·7°	4·2°	39·48	vegetable debris, sand	H. Swete.
Dudley	greenish	none	1·52	none	·2635	·0021	·0042	·0030	·0655	16·6°	6·1°	25·48	veget. debris, mycelium	H. Swete.
Edinburgh	brownish	none	·72	none	trace	·0016	·0056	·0160		5·9°	5·4°	7·68	peaty matter	J. F. King.
Exeter	f. yellow turbid	none	·91	trace	·1772	·0006	·0042		·0568	2·7°	2·7°	7·00	diatoms cotton fibres	F. P. Perkins.
Huddersfield ..	brownish yellow	f. rain watr.	·45	none	·0035	·0126	·0049	·0040	·0142	2·0°	2·0°	4·50	peaty matter	G. Jarmain.
Hull	good	none	3·00	traces	·2760	·0046	·0030	·0030	·0230	15·6°	3·4°	19·30	satisfactory	J. Baynes.
King's Lynn ..	dirty yellow opaque	dcyd. veget. matter	2·46	h. traces	·4364	·0032	·0028	·0264	·1263	15·5°	4·6°	22·82	bacteria diatoms and a leech	W. Johnstone.
Leamington ..	greenish	none	1·26	trace	none	·0021	·0021	·0084	·0161	28·0°	15·9°	28·00	satisfactory	A. B. Hill.
Leeds	light brown	peaty	·62	traces	none	·0005	·0042	·0168	·1316	4·0°	3·0°	5·32	sand, peaty matter	T. Fairley.
Leicester	urine yellow	none	·92	trace	·1700	·0006	·0146	·0040	·1680	7·9°	4·1°	14·00	vegetable matter	Wigner & Harland.
Liverpool	light brown	peaty	1·02	traces	·0620	·0028	·0014	·0140	·1120	5·2°	4·6°	9 24	satisfactory	A. Smetham.
Llandrindod ..	bluish green	none	·71	none	·0250	·0007	·0068	·0005	·0316	7·2°	2·6°	9·66	vegetable debris	H. Swete.
Maidstone	c. colourless	none	2·45	trace	1·2880	·0014	·0028	·0238	·0630	16·0°	5·3°	32·97	satisfactory	M. A. Adams.

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								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Manchester....	v. s. turbid	none	·49	none	none	·0019	·0029	·0139	·0924	1·6°	1·5°	4·76	s. mineral deposit	W. Thomson.
Newark	yellowish brwn. turbid	none	1·12	trace	·0079	·0012	·0088	·0098	·1382	16·0°	10·8°	26·93	amorphous organic mttr. mvng. organms.	A. Ashby.
Newcastle-on-Tyne......	f. yellow	none	·878	trace	·0510	·0010	·0090	0060	·0950	15·7°	6·2°	20·50	amorphous	J. Pattinson.
Norwich	p. grnsh. yellow		1·55	f. traces	f.tracs.	traces	·0100	·0019	·1031	15·0°	4·2°	18·20		W. G. Crook.
Oldham, Piethorn	yellowish green, slight opaque	veget. mttr.	·71	trace	·1000	·0098	·0050	·0040	·1000	2·4°	2·3°	6·30	vegetable debris, hair	Wigner & Harland.
Do. Strinesdale	ple. grnsh. tinge	veget. mttr.	·85	trace	·1700	·0082	·0152	·0040	·0800	5·2°	4·9°	11·80	vegetable debris, sand	
Do. Hanging-Lees	pale greenish yellow	veget. mttr.	·78	trace	·2000	·0083	·0043	·004	·0860	2·2°	2·2°	8·06	veget. debris and fibres	
Plymouth	yel. grn. s. opaq.	veget. mttr.	·95	none	·0500	·0010	·0116	none	·0640	5·0°	5·0°	5 00	algæ animalculæ	
Pontefract	f. yellow	slight	3·72	traces	9·1000	·0005	·0050	·0056	·0500	40·0°	28·8°	50·40	trace sand	T. Fairley.
Portsmouth ..	v. turbid	none	1·26	traces	·2620	·0032	·0042	·0056	·0333	14·6°	3·9°	19·74	vegetable debris much decomposed, diatoms	B. Dyer.
Reading	c. f. yellow	none	·95	trace	·1400	·0007	·0056	·0140	·0700	14·0°	4·5°	17·40	amorphous matter	J. Shea.
Rugby	turbid yellowish	none	1·18	h. traces	·3150	·0056	·0126					18·90	iron rust from pipes	A. P. Smith.
Salford	yellow	v. slight	·60	none	none	·0010	·0050	none	·0150	3·5°	3·0°	4·00	satisfactory	J. C. Bell.
Sheffield	turbid brown	none	·50	none	none	·0021	·0056	none	·1050	5·0°	4·8°	6·03	none	A. H. Allen.
Shrewsbury ..	v. s. yellow	none	1·39	traces	·3700	·0030	·0060	·0040	·0280	20·8°	5·2°	24·80	vegetable fibres	T. P. Blunt.
Southampton..	f. greenh. yellow	none	·98	h. traces	·142[illegible]	·0056	·0041	·0080	·0680	12·8°	4·0°	19·70	vegetable debris	A. Angell.
Stourbridge ..	greenish blue	none	2·30	none	·0125	·0014	·0042	·0010	·1176	16·7°	5·2°	31·36	sand, vegetable debris	H. Swete.
Stourport	turbid grnh. yellow	none	2·10	none	·6176	·0028	·0031	·0010	·0720	7·1°	1·5°	9·80	sand, vegetable debris	H. Swete.
Sunderland....	c. pale blue	v. slight	1·95	trace	·2500	·0017	·0028	·0060	none	9·6°	3·7°	25·00	vegetable debris	H. J. Yeld.
Swansea	c. yellow	none	·90	traces	none	·0007	·0070	·0020	·0040	2·5°	2·0°	4·55	none	W. Morgan.
Whitehaven ..	f. green	none	·36	trace	·0114	none	·0018	none	·0113	·5°	·5°	3·10	vegetable debris, moving organisms	A. Kitchin.
Wolverhampton	v. turbid	none	1·26	h. traces	·1610	·0007	·0119	·0083	·1299	14·4°	7·0°	20·44	veg. deb. amœbæ. diatms.	B. Dyer.
Worcester	brown opaque	slight	1·83	trace	·0290	none	·0084	·0010	·1680	10·4°	5·8°	15·54	moving organisms, animal and vegetable debris, sand, clay	H. Swete.
Trafalgar Sq., Wall Water, Lon.	c. pale, grnsh. yellw.	none	11·70	trace	trace	none	·0022	none	·0081	8·0°	1.0°	57·96		A. Dupré.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In last month's table the Oxygen of the CROYDON water absorbed in 4 hours should have been ·0180 instead of ·0800.

DRUG ADULTERATION IN AMERICA.

REPORT ON DETERIORATIONS, ADULTERATIONS, AND SUBSTITUTIONS OF DRUGS, RECENTLY PRESENTED BY MR. C. LEWIS DIEHL TO THE AMERICAN NATIONAL BOARD OF HEALTH.—*National Board of Health Bulletin: Supplement No.* 6.

Mr. Diehl does not give a re-assuring account of the purity of drugs in America. His report shows, amongst other adulteration, the following:—

ROOTS, ETC., ETC.	ADULTERATION.
Aconite	Exhausted *(tasteless)* dried root.
Arnica	Only 10 to 50 per cent. of the true root.
Hydrastis	Contained 50 per cent. beet root, serpentaria, sanguinaria, and podophyllum.
Sarsaparilla	Nutgalls, ipecac., matico stems, *paper*, bark, straw, bay, belladonna, and digitalis leaves.
Whole Pepper	Acorns "*turned*" *into small globes and dyed.*
Peppercorns	Made up of oil cake, clay, and cayenne.
Pepper of light weight	Macerated in brine to increase weight.
Ground Pepper	Pepper leaves, sage, rape seed, potato, spices, capsicum, guinea pepper, chicory, size, laurel leaves, olive stones, bone dust, dirt.
Quinine	Finely picked cotton, salicine.
Santonin	Mica, boracic acid 22 per cent., picric acid 100 per cent. (all p. a., *no* santonin).

Mr. Diehl mentions that there was till recently in Brussels "an extensive establishment for adulteration carried out with great skill."

Ships' biscuit seems to enter into the adulteration of many powdered and other drugs. Thus:—

Cape Aloes	Contained Cape aloes, *ships' biscuit*, turmeric.
Ipecac. Opium Gamboge, &c.	„ *Ships' biscuit 25 to 50 per cent.*
Scammony	„ *Ships' biscuit*, cocoa beans, lampblack, &c.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

LARD ADULTERATION.

To the Editor of "The Analyst."

Sir,—I am afraid "An Interested Chemist" did not notice the point of my letter, or else I did not make it sufficiently clear. I did not find fault with the lard having too *high* a melting point, but too *low* a one. In Wynter-Blyth's book, the melting point is said to vary from 107·6° to 113° F. I am perfectly aware that the lard is pressed to extract the oil, but that would not account for the melting point *falling* to 92°. Some lard that I prepared myself, and which had not been pressed, melted at 112·6°.

Again, granting, for the sake of argument, that pressed lard is better suited for culinary purposes, the shop lards that I tried were decidedly inferior in this respect, for I purposely experimented with each in making pastry. The lard having the lowest melting point made the worst crust, it scarcely rose a bit, and was tough; whereas the pure article made a puff paste an inch thick. I have been told by a grocer in this town that the lard manufacturers melt down *all* the pig's fat. If so, it is wrong to call the product lard. It has no more right to bear that name than dripping has to be called suet. I think it probable that this may be the true explanation of the difficulty, since I find bacon fat melts at 90°, and I did not observe any marked differences in the proportions of soluble and insoluble acids.

I am, &c.,

RUGBY, *12th Feb., 1881.* A. PERCY SMITH.

AMMONIA IN WATERS.

TO THE EDITOR OF "THE ANALYST."

SIR,—In the determination of free and albuminoid ammonia in waters, I have always had a difficulty with regard to the connection of the retort with the condenser. I had a large number of glass tubes made about 27-in. long, 1½-in. bore one end and tapering to ⅝-in. bore at the other end. The neck of the retort, wrapped with tin foil, I inserted in the condensing tube. These tubes were continually breaking on the slightest strain or bumping of the retort; besides, the steam inside the tube and the cold water on the outside had also a tendency to make the glass more liable to fracture. Again, the securing of the glass tube in the condensing box was difficult to contend with—indiarubber tubing, bound up carefully, would, after a little time split. At last I resolved to try condensing tubes of the above size, made of block or fine tin. They were made by Messrs. Johnson, Matthey & Co., and I have found them to answer admirably. The tubes are connected with the condensing box by means of solder, this doing away with any possible leakage. Before using them in water analysis, I found it necessary to steam them out; that is by connecting the retort and distilling off a litre or two of water through the tubes, the condenser being empty meanwhile. Any brother analyst, having the difficulties to contend with as I used to have, will find it advantageous to try the above. I may add, the condenser I used is a copper box about 18-in. long, 5-in. deep and 3½-in. wide. This filled with water stands firmly on a stand made for it, the tin condenser passing obliquely through the box.

Yours faithfully,

SWANSEA, *Feb. 22nd, 1881.* W. MORGAN.

ANALYSTS' REPORTS.

Mr. Alfred Stokes, Public Analyst for the parish of Paddington, in his report for the quarter ending December 25th, 1880, mentions a sample of milk which contained no less than 40 per cent. of added water, and a sample of whisky which was diluted with 76 per cent. of water.

At the Quarterly Meeting of the Bristol Town Council, recently held, Mr. F. W. Stoddart, Public Analyst, presented his report for the past quarter, in which he said he had received from the inspector and the public seventy-one samples of food, and of these he found twelve to be adulterated and one to be unfit for food. A sample of butter forwarded by one of the public was found to contain less fat than butter. Five samples of butter forwarded by the inspector were found to be genuine. Two samples of coffee and chicory, three samples of mustard farina, two samples of mustard, and two samples of coffee, all furnished by the inspector, were found to be genuine.—In a discussion which took place on a report of the Watch Committee, Mr. A. W. Warren said he wished to call attention to the article sold in shops under the name of butterine. It was sold largely retail in Bristol, and he saw in London notice was being taken of the article, and the public were protected from it. He thought the public should be protected in Bristol, and the Watch Committee ought to take steps relative to the sale, as the stuff was sold in enormous quantities. It was a combination of low fats treated in a chemical way and coloured with annatto: but there was no butter in it. The stuff was sold as butter, and he hoped that this and other articles, which were sold under other names than what they really should bear, would receive proper attention.—Mr. H. G. Gardner, wholesale grocer, said he agreed with the statement that articles should not be sold under other names than what they really bore, but he would be sorry to see wholesome fat prohibited from being sold to poor people, as butter was at such a high price. Butterine was quite wholesome, and the only objection he had to it was when it was sold as butter; and he had as much objection to that as Mr. Warren could have. But, for goodness' sake, let it be sold! The fat was as wholesome as butter, and half the price.—Mr. A. Baker did not think they need discuss the merits of butter and butterine, but the attention of the Public Analyst should be called to all kinds of articles of food, and not merely to one; let justice be meted out all round.—Mr. M. Whitwell said he had been in America and seen the whole process of making butterine, and, although it contained no butter, it was, he could say, an extremely wholesome article. It was made from the best fat that could be got, the stearine removed, and then churned with milk.—Mr. Cordeux said the attention of the analyst had been directed to other articles besides butter during the quarter. The discussion then dropped.

LAW REPORTS.

Butter or Butterine?—

At the Aston Police Court, Birmingham, on Feb. 5th, before Messrs. A. Hill, J. D. Goodman, and J. T. Collins, William John Bryant, dairyman, of 160, Aston Road, Birmingham, was summoned by Benjamin Bolt, an inspector under the Sale of Food and Drugs Act, for selling one pound of butter not of the nature, substance, and quality demanded by the purchaser. Mr. J. Ansell appeared for the prosecution. On the 10th ult. the inspector sent a youth into defendant's shop for a pound of tenpenny "butter," with which he was supplied. The inspector then went into the shop and told the defendant that the butter would be analysed. The defendant's sister, who had served the butter, said it was not butter, but "butterine" or "oleine." In reply to Mr Buller, solicitor, who appeared for the defendant, prosecutor said he was not deceived, as he believed it was butterine or oleine. Mr. Buller for the defendant contended that as the actual purchaser did not state that the butter was bought for the purpose of analysis, the summons could not be supported. He also urged that there was no such an article as "tenpenny butter," and that the lowest price for butter was 1s. 2d. per pound. The defendant was in the habit of placing a ticket on the article describing it as fine oleine, but on the morning in question the ticket was taken away to be cleaned. The magistrates considered the case proved, and fined the defendant 5s. and costs. Mr. Buller asked for a case on the point he had raised that the purchaser did not state the butter was for analysis, and the magistrate granted a case.

At West Bromwich Police Court, on Monday, Mr. Thomas Brady, grocer, Meeting Street, was charged with selling adulterated butter on the 17th inst. Mr. Topham appeared for the defendant. Alfred Toy, assistant inspector, stated that when he entered the defendant's shop he asked the daughter who was behind the counter, to sell him one pound of butter, which she did, and for which he paid 1s. 2d. Mrs. Brady afterwards came in and said that she had the butter from Mr. Garratt, wholesale dealer, West Bromwich. The price of salt butter was now 1s. and upwards per pound. Mr. Horder, inspector under the Act, said that a sample of the butter had been sent to the analyst, who certified that it was a fictitious article, containing 8 per cent. of butter fat. For the defence it was stated that Toy went into the shop and asked Mrs. Brady for a pennyworth of milk, and while she went into the dairy to fetch it, Toy asked her daughter to supply him with "that pound of butter" which was in the window. While the daughter was in the act of reaching the butter to Mr. Toy, Mrs. Brady came back with the milk, and said that it was not butter, but oleine, and that it was from Mr. Garratt, of West Bromwich. Toy said he supposed it was made at West Bromwich, and he therefore divided the article into three parts. The case was dismissed.

Constituents of Chemical Food for Infants:—

Sheriff Balfour, of Glasgow, had before him, on the 10th inst., a case in which a grocer carrying on business in that city was charged with contravening Section 7 of the Sale of Food and Drugs Act, 1875, he having on the 13th ult. sold a bottle of compound syrup of phosphates, or chemical food for infants, which was represented to contain, in every teaspoonful, two grains and a half phosphate of lime and one grain of iron, but which when analysed was found to contain only about a third of a grain of phosphate of lime and a quarter of a grain of iron. He was liable to a penalty of £20. The accused tendered a plea of guilty. and Mr. Bell, who appeared on his behalf, briefly addressed the Court. He pointed out that his client bought the bottles from a manufacturing chemist wholesale, and did not know the ingredients. He also mentioned that the difference in price between the "food" as sold and as it should be sold was only ½d. per lb. The Sheriff observed that the offence was not a serious one. His Lordship imposed a fine of £3.

Selling Diluted and Impoverished Milk:—

James Dearnley, milk dealer, of Almondbury Bank, Huddersfield, was charged with selling diluted and impoverished milk. Mr. Kirk, the sanitary inspector, said that on the 24th December he saw the defendant hawking milk in Moldgreen, and he instructed a person named William Beaumont to obtain from him a pint of milk. He obtained the milk, for which he paid twopence. He (Mr. Kirk) was in a position to hear what was said. As soon as Beaumont had paid for the milk he informed the defendant that he had bought it for the sanitary inspector, whereupon the defendant said he was having him "on;" and asked him where Mr. Kirk was. He (Mr. Kirk) then went up to him, took hold of the milk, told him he was the sanitary inspector, that he had bought the milk for analysis, and asked him if he wished to retain a part of it. He had no sooner said that than the defendant seized him by the right arm, tried to upset the vessel containing the milk, and he so far succeeded that three parts of it were spilled; but there was a sufficient quantity retained for analytical purposes. Witness reminded him of the serious position in which he was placing himself, when the defendant said he was determined he should not have any of his milk. The milk was analysed, and the analyst's report showed that it contained 42 per cent. of added water, and it had also been deprived of 85 per cent. of its butter fat! Witness said it was one of the worst cases he had ever had; and Mr. Jarmain, the Borough Analyst, said he never before analysed so bad a sample. This, he said, took place when there was an outbreak of scarlet fever in the town, and when the patients were requiring a milk diet. The defendant said Mr. Kirk was exaggerating the case, and he was sorry it had arisen. The defendant said the milk was just as he got it from other farmers, but, on being pressed by the Bench for their names, he was unable to give one of them! The Chief Constable informed the Bench that in June, 1879, the defendant was fined £5 and costs for a similar offence, and Mr. Kirk added that in that case the whole of the cream had been removed. The defendant asked the Bench to be as merciful as possible. He was told that the case was a serious one, and he ought to sell good milk. He would be fined £10 and costs, and the Mayor said he richly deserved a heavier penalty.

NOTE OF THE MONTH.

The National Board of Health of the United States of America, which, at the present time, really seems to be doing a large amount of extremely useful work, has just issued the following notice, which clearly shows that the authorities on the other side of the Atlantic are becoming aware, like ourselves, of the great necessity there is for a uniform and systematic analysis of Public Water Supplies:—

A careful study of the chief methods in use for the chemical examination of potable water, so far as organic matter is concerned, has been undertaken by order of the National Board of Health. It is particularly requested of the correspondents of the board, of medical men throughout the country, and of others interested in sanitary matters, that any well-marked case of disease which may seem on medical grounds fairly attributable to organic impurities in drinking water be promptly reported to Dr. J. W. Mallet, University of Virginia Post-office, Albemarle County, Virginia, with a few lines stating clearly the medical nature of the case, and the character of the evidence on which the water in question is suspected of having actually caused disease in persons who have used it.

It is further desired that a sample of each such water be forwarded for examination, *but not until notice has been received from Dr. Mallet that the analysts are ready to proceed with it,* since it is important that no useless delay should occur between the shipping of the sample and its investigation in the laboratory. In notifying any one who may be able to furnish specimens of suspected waters that may be forwarded, clear instructions will be sent as to the quantity of water required, and the mode of collecting, packing, and shipping it.

It is particularly desired that no case be presented on doubtful or vague evidence, since one important object of the inquiry demands that all such be rejected, and only those cases examined which involve the strongest grounds for believing that mischief has really been caused by organically foul drinking water.

The cost of packages and transportation for samples will be borne by the Board of Health.

In order to distinguish genuine butter from so-called oleomargarine, Hager, we read, saturates a cotton-wick with the melted sample, lights, and allows it to burn for two minutes, and judges its quality by the smell. Artificial butter gives the well-known offensive odour of an extinguished tallow candle.—*Provisioner.*

A public laboratory for the analyis of anything sold as food has been established in Paris by the Prefect of the Seine, the fees being limited to from five to twenty francs, according to the difficulty of the operations.—*Provisioner.*

Dr. Ebenezer Evans has been appointed Public Analyst for the county of Anglesey, at one guinea per analysis, vice Owen, resigned.

Mr. James Napier, F.C.S., has been appointed Public Analyst for the borough of Sudbury, at five guineas per annum and fees.

Mr. A. W. Stokes, F.C.S., has been appointed Public Analyst for the parish of St. Matthew, Bethnal Green, vice Tidy, resigned.

RECENT CHEMICAL PATIENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
2516	C. D. Abel	Manufacture of Betanaphthylamine, &c.	2d.
2605	G. W. Von Nawrocki	Mechanically Incorporating Indiarubber with Hydro-Carbon Oils	2d.
2610	J. H. Johnson	Telephones	6d.
2665	W. R. Lake	Protective and Insulating Casings for Underground Telegraph Wires	6d.
2682	E. A. Kirby	Treatment of Meat	4d.
2706	F. N. Mackay	Manufacture of Snow	6d.
2719	C. G. Pfander	Preparation of Materials for Clarifying Sugar Oils, &c...	
2729	L. Perrier	Steam Tension Manometer for Analysing Liquids and Studying Pressures	6d.
2736	J. H. Johnson	Manufacture of Alcohol	4d.
2764	G. G. André	Electric Lamps	8d.
2784	A. Domeier and J. Marzell	Manufacture of Artificial Alizarin	4d.
2816	E. Edmonds	Carburetting Air	6d.
2826	J. Imray	Telephones	2d.
2831	T. H. Gray	Treatment of Vegetable Oils	4d.
2865	J. A. Lund	Synchronising or Setting Clocks	2d.
2878	F. A. Zimmermann	Manufacture of Bitter Almond Oil, Benzoic Acid, &c.	4d.
2885	W. Brierley	Extracting Ammonia during Distillation of Azotic Substances	2d.
2902	B. H. Remmers & J. Williamson	Refining or Purifying Sugar, &c.	4d.
2929	G. O. Willis	Medicated and other Aerated Waters	2d.
4091	J A. Dixon	Colouring Matters for Dyeing and Printing	4d

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Practical Chemistry, by Hurst & Madan.

THE ANALYST.

APRIL, 1881.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held at Burlington House, on Wednesday, the 16th March, the President, Mr. Heisch, in the chair.

The President announced that in accordance with the resolution passed at the Extraordinary Meeting, held on the 16th February, the Council had elected Mr. F. Maxwell Lyte, as the second secretary of the Society for the remainder of the current year. Mr. Lyte was too well known for it to be necessary for him to say one word, except that it was a very good thing for the Society to have obtained his services.

A letter from Monsr. E. Chevreul, accepting the Honorary Membership, was read and ordered to be entered on the minutes, and that letter and those from Dr. Hofmann and Professor Fresenius, which were read at the previous meeting, were, if possible, also to be published.

Dr. Bartlett and Mr. B. Dyer, having been appointed as Scrutineers to open the ballot papers, announced that the following gentlemen had been elected:—As Members—John Parry, Public Analyst for Penryn; W. D. Sykes, M.D., Public Analyst for Portsmouth; H. Liepmann, Ph.D., F.C.S., Analytical Chemist, of Leadenhall Street, London. As Associates—W. Fox, Assistant to Mr. J. Baynes, of Leeds; D. A. Sutherland, Assistant to Dr. Drinkwater, of Edinburgh.

The following gentlemen were proposed for election as Members, and will be balloted for at the next Meeting:—W. L. Emmerson, M.D., &c., Public Analyst for the County of Leicester, &c.; H. Meadows, M.B., Public Analyst for the Borough of Leicester; R. Oxland, F.C.S., Public Analyst for Plymouth and Devonport; W. F. K. Stock, Public Analyst for Durham.

The following papers were then read and discussed: "The Swedish Acts for regulating the Sale of Poisons," by C. Heisch, F.C.S., F.I.C.

"Some Analyses of Milk," by Bernard Dyer, F.C.S., F.I.C.

"On Samples of Milk which have fallen below the Society's Standard," by J. Carter Bell, F.C.S., F.I.C.

"On a New Method for the Estimation of Nitrates in Potable Water," by J. West-Knights, F.C.S.

"Nitrates in River Waters," by F. P. Perkins, F.C.S.

The following are the letters from the recently elected Honorary Members referred to above:—

Museum d'Histoire Naturelle, Paris, *13 de Février, 1881.*

Cher Monsieur,—Après avoir lu votre lettre, et pris connaissance du groupe des Savants auxquels le Conseil de la Société a bien voulu associer mon nom, on ne peut croire, quel que fut l'opinion que l'on eut de la valeur de ses propres travaux, qu'on se trouva pas honoré d'appartenir au groupe des honoraires de la Société nouvelle. Veuillez donc, Monsieur, donner connaissance de cette lettre,—en réponse à celle que vous m'avez adressée,—au Conseil de la Société, afin qu'il sache, de moi-même, que celui qui s'honore du titre de doyen des étudiants de France, ne peut que s'honorer du titre de membre honoraire de votre Société. Si ma vie scientifique a été heureuse, c'est d'avoir eu de la nation Anglaise, qui a été si grande, à mon sens, dans toutes les branches des connaissances humaines, des titres de son estime, pour des travaux dont le but, en toutes choses, a été la verité. Que le Conseil sache donc, combien je en'honore d'être le doyen des associés étrangers de la Société Royale de Londres, comme je la suis de l'Académie des Sciences de l'Institut de France, et quelle m'ait juge digne de lui appartenir.

Veuillez, Monsieur le Secrétaire Honoraire, agréer l'expression de mes sentiments de haute et profonde estime.
E. CHEVREUL.

10, Dorothein Strasse, Berlin.

Dear Sir,—I hasten to acknowledge the letter informing me of the great distinction the Society of Public Analysts have conferred upon me by electing me their Honorary Member. I deem it indeed a great honour to belong to so important and useful an association as the Society of Public Analysts has rapidly become, and this honour in my eyes is doubled by its coming from dear old England, so long the country of my adoption, and of which as long as I live I shall always bear a most grateful recollection.

Will you be so good as to convey the expression of heartfelt thanks to my new colleagues for the honour they have done me.

And believe me, dear Sir, ever yours very sincerely,

G. W. Wigner, Esq., Hon. Sec. Society Public Analysts.
A. W. HOFMANN.

Wiesbaden, 10th February, 1881.

Dear Sir,—In receipt of yours of the 5th inst., I shall be glad to accept the election as an Honorary Member of your esteemed Society, by which you pay a great compliment to my researches in analytic chemistry.

Accept my best thanks on behalf of yourself and your Society for the honour you confer on me.

With compliments, I am, yours truly,

G. W. Wigner, 79, Great Tower Street, London, E.C.
C. R. FRESENIUS.

The next Meeting of the Society of Public Analysts will be held at Burlington House, on Wednesday, the 18th April.

ON A NEW METHOD FOR THE ESTIMATION OF NITRATES IN POTABLE WATER.

By J. West-Knights, F.I.C., F.C.S.

The most delicate test we have for nitric acid is undoubtedly the brucine test, and perhaps it is one of the most delicate tests in the whole range of analytical chemistry, for the red colour produced by it from one part of nitrogen as nitrate, is distinctly perceptible when diluted with ten million parts of water: and yet, so far as I am aware, this test has never been made a quantitative one.

This may, perhaps, be accounted for in the fact that in using this test in the ordinary way, with excess of HNO_3 (as in testing for brucine), or with excess of H_2SO_4 (as in testing for nitrates), the red colour is destroyed almost as soon as produced, the result being an orange or brown colour, the intensity of which is diminished, or the colouration altogether disappears.

But if certain precautions be taken the blood-red colour is perfectly permanent.

If oxalic acid be employed instead of sulphuric, in applying the test to nitrates, and provided that the nitrate is not present in greater proportion than one molecule of NO_3 to one of brucine the red colour is produced permanently, not only from nitrates of the alkaline earths but also from nitrates of the alkalies.

To apply this to the estimation of nitrates in water, it is merely necessary to evaporate a measured quantity of water to dryness, moisten the residue with solutions of brucine and oxalic acid, again evaporate to dryness, dissolve the red residue in water, filter and compare the colour with a standard red colour, produced in the same way from a weighed quantity of nitrate of potash. The solutions required are:—

Nitrate of Potash Solution.—·721 grm. of pure nitrate of potash are dissolved in one litre of distilled water; one c.c. of this solution contains ·0001 grm. of nitrogen as nitrate.

Brucine Solution.—Dissolve one grm. of brucine in 100 c.c. of alcohol; each c.c. contains ·01 grm. brucine.

Oxalic Acid Solution.—A cold saturated solution.

Standard Red Solution.—Evaporate 10 c.c. of nitrate of potash solution to dryness in a platinum dish over a beaker of boiling water, moisten the residue with 3 c.c. of brucine solution and about 6 drops of oxalic acid solution, and again evaporate gently to complete dryness, moisten the red residue with a few drops of distilled water and once more evaporate to complete dryness, dissolve the residue in a little distilled water on the water-bath, wash the solution into a hundred c.c. flask and fill up to the mark with distilled water. This solution should have a bright red colour, with no appearance of orange or brown even when considerably diluted; 1 c.c. is equal to ·00001 grm. of nitrogen as nitrate (the same strength as the dilute ammonia used in nesslerizing).

The sample of water is now prepared in a similar manner: 10 c.c. are evaporated to dryness, and brucine solution added to the residue in sufficient quantity, from 0·5 c.c. to 2 c.c. according to the quantity of nitrate present. It is advisable not to have a large excess of brucine, but it is absolutely necessary for the production of a full red colour that there should be a slight excess, or at least an equivalent. As a first trial 1 c.c. may be used, which will generally be found sufficient, but if the colour produced is a decided brown and not comparable with the standard red, a fresh quantity of the water must be taken and more brucine solution used until the result is satisfactory: if on the contrary, a very slight pink colour is produced, indicating 1 or 2-10ths of a grain of nitrogen as nitrates per gallon, a smaller quantity should be used. Three or four drops of oxalic acid should be added and the whole gently evaporated to complete dryness, moisten the residue, which, if enough brucine has been used will be perfectly red, with a few drops of water and again evaporate; now dissolve the residue on the water-bath in a little water and filter into a white glass cylinder marked at 50 c c. and fill up to the mark with water; now imitate the colour exactly in another cylinder by using from 1 c.c. to 10 c.c. of the standard red made up to 50 c.c. with water. If the colour produced by the 10 c.c. of water is deeper than that produced by 10 c.c. of the standard red, it must be diluted with one or two volumes of water and 50 c.c. used as before; if it is lighter than 1 c.c. of the standard, then 20 c.c. or 30 c.c. of the water must be evaporated instead of 10 c.c.

When 10 c.c. of water are used, the number of c.c. of standard red required to produce a similar tint multiplied by 7 and divided by 100 equals grains per gallon of nitrogen as nitrates.

Although so small a quantity of water as 10 c.c. is employed for the estimation of nitrates by this method, and in fact 1 c.c. may be used in some cases, it is fully as accurate as the aluminium method, for although in that method a much larger quantity of water is taken initially, the actual estimation takes place in the same amount as in the brucine method, and not only is the red colour more striking to the eye than the yellowish-brown colour in nesslerizing, but it is also permanent and does not change on standing.

I give below estimations of nitrates in two samples of water both by the brucine and aluminium methods, the samples were selected as giving a fairly low and a very high proportion of nitrates respectively.

Cambridge Water.—March Sample.

N. as Nitrates	·460	grs. per gallon	Al. Method.
,, ,, ...	·455	,,	,, Brucine ,,
,, ,, ...	·490	,,	,, ,, ,,
,, ,, ...	·462	,,	,, ,, ,,

A Polluted Well Water.

N. as Nitrates	4·270	grs. per gallon	Al. Method.
,, ,, ...	4·200	,,	,, Brucine ,,
,, ,, ...	4·550	,,	,, ,, ,,
,, ,, ...	4·200	,,	,, ,, ,,

I regret I have not had time to bring forward a larger number of analyses to support the accuracy of this process, but the whole operation is so simple and speedy that I am led to hope that some of the members of this Society, especially those that are connected with the water scheme, will give it a fair trial and communicate the results to the Society.

ON THE ESTIMATION OF NITRATES IN RIVER WATER.

By Frank P. Perkins.

Read before the Society of Public Analysts on 16*th March*, 1881.

Many are the processes that have been devised for the estimation of nitrates; nevertheless, the method here described may, perhaps, be found worthy of your consideration: not the less so from its constancy and extreme simplicity. I have observed that if 100 c.c. of the water to be examined are put into a perfectly bright and freshly ignited platinum dish, together with a very small portion of sodium chloride (the commercial salt may be used if previously ignited to get rid of any trace of organic matter it may contain), on introducing into the saline liquid a coil of magnesium (made from a piece of ribbon about three feet in length by simply coiling it round a glass rod, and subsequently cleansing it from oxide by immersing it in dilute hydrochloric acid and washing with water), immediately that contact between the platinum and magnesium is gained, electrical action ensues and the water is decomposed. At first the action is somewhat slow, but in a very few minutes a torrent of minute gas bubbles ascends through the liquid. Should the water contain nitrates these are reduced—through the action of the nascent hydrogen—and converted into ammonia. A slight elevation of temperature considerably hastens the decomposition, but in practice nothing is gained by this. During the experiment the platinum dish is covered with a clock glass, then placed on a plate of ground glass, and for further security a small bell jar, the mouth of which is also ground, is inverted over it, contact with the air being thus in a great measure prevented. Thus it rests during the night, or until the whole of the magnesium is dissolved. The convex surface of the clock glass is then rinsed with pure distilled water into the dish, and the electrolysed liquid, or a measured portion thereof, transferred to a flask, and the ammonia distilled off and nesslerized in the usual way.

As a platinum dish of the required size may not always be at hand, it has been my endeavour to arrange the experiment in a less costly manner without detracting from its completeness. The following arrangement will be found all that can be desired on this score. Into a wide-mouthed four-ounce bottle a round plate of platinum foil, perfectly clean, and of about the same diameter as the interior of the vessel, is placed and allowed to lie flat and loose on its bottom. To the mouth of the bottle a sound cork is fitted (a caoutchouc stopper must not be used) and through its centre a piece of quill tubing a few inches long, drawn out at one end to a fine orifice, and filled with beads or minute fragments of glass, is passed. Into this apparatus the water prepared as already shown is placed, and the coil of magnesium having been dropped in and the contents of the little tube moistened with water, the cork is fixed firmly in position and the decomposition allowed to proceed. At the conclusion of the experiment the little tube (which may contain traces of ammonia) and the under surface of the cork are rinsed into the larger vessel, the loss of ammonia being thus prevented. The determination of the ammonia is then made, a correction for the amount of free ammonia originally contained in the water being of course necessary. The working of the process will be seen from the following experiments.

Exeter Water.—Per 100,000 parts.

No. 1	·2587	Nitrogen as Nitrates.
No. 2 (another sample)	·2802	,, ,,
The same water treated by the Al. process gave ...	·2588	,, ,,

In the discussion on the papers on Nitrates in Water, by Mr. West-Knights and Mr. Perkins,

Dr. Muter said they were scarcely in a position to discuss them at present, but it was very gratifying that the younger members of the Society should be coming forward so well lately. He suggested the desirability of postponing any discussion till they had had an opportunity of trying the processes.

Dr. Dupré said it seemed to him that the real way to get at nitric acid was to convert it into ammonia. It was the only philosophical way. The Brucine method laboured under the same disadvantage as the Indigo process—they did not know exactly what it gave, and it differed with various waters.

Mr. West-Knights, in replying, said that the Brucine test must not be put on a par with the Indigo process, because some compound of Brucine had, he believed, been produced in a crystalline form, and, therefore, it was quite as much a definite process as the Ammonia process.

SOME ANALYSES OF MILK.

By Bernard Dyer, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 16th March, 1881.

In the course of some experiments on the feeding of dairy cows, recently carried out under my joint supervision in Sussex, I have had occasion to submit to analysis a large number of samples of milk from several cows, including weekly samples of morning and evening milk during a period extending over some months. In the course of these investigations a large number of samples, the genuineness of which was quite above question, differed so materially from the standard adopted by the Society of Public Analysts, that I have thought it worth while to bring some of the results before the Society. I do not propose here to refer in detail either to the general system or the results of the experiments themselves, which were undertaken to ascertain the comparative value of certain foods, as affecting the gross yield of milk. The analyses were made in order to ascertain what fluctuations in quality might accompany fluctuations in actual yield, and although merely incidental to the practical questions involved from the farmer's point of view, they naturally constitute the chief point of interest to our Society.

COWS A. AND B. (A. Pure Bred, B. half bred.)

These were Sussex cows that had calved a few weeks previously to the first analysis and were apparently in perfect health.

The following analyses were made while the cows were fed on a pure grass diet, on good pasture land without any artificial food whatever:—

		A.					B.			
		Total Solids.	Fat.	Solids not fat.	Ash.		Total Solids.	Fat.	Solids. not fat.	Ash.
July 2nd		12·86	3·94	8·92	·68	..	11·88	3·15	8·73	·72
„ 8th	M.	12·91	3·76	9·15	·69	..	12·03	3·14	8·89	·70
	E.	13·31	3·79	9·52	·69	..	12·45	3·40	9·05	·69
„ 9th	M.	12·42	3·06	9·36	·68	..	12·38	3·62	8·76	·71
	E.	14·63	5·81	8·82	—	..	11·92	3·27	8·65	—
„ 17th	M.	12·42	3·36	9·05	·65	..	12·28	3·40	8·88	·65
	E.	12·99	3·97	9 02	·67	..	11·80	3·32	8·48	·69
Average		12·80	3·64	9·16	—		12·10	3 33	8·77	—

During the above period the quantity of milk yielded by B., exceeded that yielded by A. by 27 quarts a week. The cows then received, in addition to grass, a liberal allowance of good oil-cake.

		A.					B.			
		Total Solids.	Fat.	Solids. not fat.	Ash.		Total Solids.	Fat.	Solids not fat.	Ash.
Aug. 4th.	E.	12·29	3·30	8·99	·66	..	11·95	3·55	8·40	·70
„ 5th.	M.	12·76	3·57	9 19	·67	..	11·89	3·51	8·38	·68
„ 11th.	E.	13·36	4·17	9·19	—	..	12·49	3·69	8·80	·70
„ 12th.	M.	14·80	5·56	9·24	—	..	12·13	3·17	8 96	·65
„ 18th.	E.	15·24	6·28	8·96	·70	..	12·38	3·52	8·86	·71
						..	12·69	3·61	9·08	—
Average		13·69	4·58	9·11	—		12·25	3·51	8·74	—

Up to this point B. was giving 90 quarts per week, being 30 quarts in excess of A. On Aug. 19th, however, A. suddenly fell off in her milking, and was removed from the experiments, having maintained a pretty steady average of 9·1 per cent. of "solids not fat." The sudden rise in fat on and after Aug. 12, follows an increase in the quantity of oil-cake, but is probably due to the abnornal conditions which caused her to fall off in her milk shortly afterwards. The experiments were continued, substituting for A., cow C., a shorthorn. An analysis of this cow's milk on grass only, on July 27th, gave—

C.		
Total Solids.	Fat.	Solids not fat.
13·39	4·48	8·91

The analyses of B. and C. were continued from the date at which A. was set aside, both cows being fed on grass and oilcake.

		C.					B.			
		Total Solids.	Fat.	Solids not fat.	Ash.		Total Solids.	Fat.	Solids not fat.	Ash.
Aug. 17th.	E.	13·41	4·59	8·82	·74	..	—	—	—	—
„ 18th.	M.	12·96	4·07	8·89	·67	..	—	—	—	—
„ 25th.	E.	13·22	4·87	8·35	·69	..	12·45	[illegible]	[illegible]	·6[illegible]
„ 26th.	M.	11·12	2·40	8·72	·65	..	12·17	[illegible]	[illegible]	·71
Sept. 9th.	E.	11·54	2·55	8·99	·70	..	11·81	[illegible]	[illegible]	·69
„ 13th.	M.	14·04	4·83	9·21	·70	..	12·90	4·10	8·80	·64
„ 28th.	M.	14·11	4·58	9·53	·70	..	13·67	[illegible]	[illegible]	·68
„ 29th.	E.	15·23	5·79	9·44	·67	..	12 67	3·85	8·82	·67
Average		13·20	4·21	8·99	—		12·[illegible]1	[illegible]	[illegible]	—

At this time B. had gradually decreased in her yield, but was still giving 75 quarts per week. C. was not doing so well as regards quantity, and the cows were then taken indoors, this stage of the experiments having been concluded.

It will be noticed that B., throughout the three months, averaged only 8·7 per cent. of solids not fat, and only on one occasion was the limit of the Society actually reached, viz., on Aug. 19th, when the morning milk yielded 9·08 per cent. of solids not fat. Judged by the 9·3 per cent. standard, this milk, although perfectly genuine and from a healthy well-fed cow, would have been pronounced to be adulterated with 6 to 7 per cent. of water, while on one occasion the dilution would have estimated at 10 per cent., when in reality there was no dilution at all. Later in the year when B. was being stall-fed, and had little or no exercise, I had occasion to make some further analyses, and found the quality of her milk altogether different.

B. (Stall-fed).

		Total Solids.	Fat.	Solids not fat.	Ash.
Nov. 18th.	E.	14·94	4·81	10·13	·80
„ 19th.	M.	16·04	5·91	10·13	·74
„ 24th.	E.	14·30	4·12	10 18	·78
„ 25th.	M.	14·74	5·03	9·71	·67
Dec. 1st.	E.	14·66	4·80	9·86	·74
„ 2nd.	M.	14·41	5·02	9·39	·71
„ 8th.	E.	13·14	3·40	9·74	·77
„ 9th.	M.	13·81	4·50	9·31	·71
Average		14 51	4·70	9 81	—

I now refer to some analyses obtained in experiments made on stall-fed cows, E. and F., but I first give analyses of the milk of these two cows, while still on grass and oil-cake. The cows were a cross between Shorthorn and Jersey. The stall feeding begins on Oct. 31st.

		E.					F.			
		Total Solids.	Fat.	Solids not fat.	Ash.		Total Solids.	Fat.	Solids. not fat.	Ash.
Sept. 6th.	E.	11·63	2·26	9·37	·69	..	12·51	3·62	8·89	·71
„ 8th.	M.	13·16	3·99	9 17	·71	..	14 78	5·87	8·91	·71
Oct. 31st.	E.	13·19	3·12	9·56	·68	..	13·13	4·29	8·84	·71
Nov. 1st.	M.	14·25	3·13	9·71	·75	..	13·20	4·09	9·11	·73
„ 8th.	E.	13·60	3·82	9·78	·68	..	12·56	2·93	9 63	·71
„ 9th.	M.	14·01	4·03	9·98	·77	..	13 59	4·46	9·13	·78
„ 14th.	E.	13·01	3 65	9 36	·74	..	13·45	2 81	9 16	·67
„ 15th.	M.	13·67	4·01	9·66	·84	..	13·90	2·95	9·33	·80
„ 21st.	E.	14·28	4·70	9 58	·71	..	15 26	6·12	9·14	·77
„ 22nd.	M.	14·06	4·32	9·74	·71	..	14·11	4·40	9·71	·77
„ 28th.	E.	14·17	4·51	9·63	·77	..	13·51	4·17	9·34	·71
„ 29th.	M.	13·34	3·38	9 96	·76	..	13·77	4·74	9·03	·71
Dec. 5th.	E.	15·01	5·38	9·63	·74	..	13·50	4·27	9 23	·73
„ 6th.	M.	14·13	4·55	9 58	·71	..	12·66	3·50	9·16	·71
„ 12th.	E.	14·10	4 50	9·60	·71	..	13 66	3·12	9·43	·75
„ 13th.	M.	12·97	3·96	9·01	·74	..	13·11	2·93	9·02	·70
Average		13·66	4·08	9·58	—		13·20	4·01	9·19	—

The foregoing analyses illustrate what has frequently been pointed out before—that stall-fed cows give richer milk than cows at grass, even when supplied with additional food in the shape of oil-cake, and they give good examples of the great variations to which the milk, even of individual cows, is subject. It will be said, of course, that, as a rule, the Public Analyst has not to deal with the milk of individual cows, but with the mixed milk of several cows; and that the chances are in favour of the mixed milk, when pure, coming up to or above the limit fixed by the Society. In the produce of large dairies this is probably true; but the fact that an individual cow in good health and well fed can frequently give milk yielding on an average only 8·7 of solids not fat should make us cautious in giving certificates of adulteration. It will be noticed that, although in these earlier analyses Cow B only averages 8·7 of solids not fat, her fat, nevertheless, rises to about 3·5, giving total solids about 12·2. This is an excess of 1 per cent. over the minimum of fat fixed by the Society; but, still, the milk, judged on the "solids not fat" basis, would be deemed adulterated. And it must be admitted, to my mind at all events, that a person purchasing genuine milk, containing even only 8·5 per cent. of "solids not fat" with 3 per cent. or 3·5 of fat, gets better value for his money than if he purchased "standard" milk, containing 9 per cent. of "solids not fat" with 2·5 of fat. The proportion of fat should be very carefully considered, in conjunction with the "solids not fat," before an opinion as to adulteration is pronounced.

SAMPLES OF MILK WHICH HAVE FALLEN BELOW THE SOCIETY'S STANDARD.

By J. Carter Bell.

Read before the Society of Public Analysts on 16th March, 1881.

It has been my custom for some years when I receive a sample of milk which I consider adulterated, to trace that milk to its source and to find out whether the addition of water was contributed by the farmer, or by the milk dealer, or whether they were both innocent and the impoverished milk was really due to the half starved cow, and out of the many hundred samples which have passed through my hands only in about two instances have I found it necessary to differ from the standard laid down by this Society. I consider this fact to be a very great proof of the fairness of this standard.

The first instance in which the milk fell below the standard was the following. On the 18th of April, 1879, I received a sample of milk from Crewe, which gave—

Total solids	10·40
Solids not fat	8·00
Fat	2·40
Ash	·61

I wrote to the Inspector asking him to obtain a sample of milk direct from the cows. On April 23rd another sample was sent, which was taken just as the milk left the cowshed; this milk gave—

Total solids	10·75
Solids not fat	8·30
Fat	2·45
Ash	·68

I was not satisfied with this sample, but wrote to the Inspector and told him he must send me a sample of milk which he had seen taken from the cows himself. A third sample was taken from two cows, on the evening of April 24th, in the presence of the Inspector.

The total solids were	10·08
Solids not fat	8·07
Fat	2·01
Ash	·65

On May 1st I went over to the farm, and found seven half-starved cows, looking like animated bundles of bones—so miserable was their appearance. A little hay was all their food. The cows were thoroughly milked in my presence, and the milks yielded the following results:—

Specific Gravity	1031	1029	1031	1028	1038	1028	1031
Total solids	10·61	11·10	12·34	9·10	12 00	10·59	11·57
Solids not fat	8·11	8·38	9·35	8·04	9·80	7·98	8·89
Fat	2·50	2·72	2·99	1·06	2·20	2 61	2·68
Ash	·69	·65	·69	·75	·72	·64	·73

The second instance which has fallen under my notice was from a gentleman's farm in Cheshire. The farm was kept up for his pleasure, but managed by a person who did not understand cow keeping. The milk was sent into Salford, and a sample of it gave—

Total solids	11·12
Solids not fat	8·50
Fat	2·62

I visited the farm and saw 22 cows in the shippons. Each cow was milked in my presence, and each sample analysed; the mean of the lot was—

Total solids	11·42
Solids not fat	8·55
Fat	2·87
Sp. Gr.	1030

The two extreme cases were—

Specific gravity	1030	1028
Total solids	13·71	10·70
Solids not fat	9·37	7·92
Fat	4·34	2·78

This poorness of milk I attribute to bad feeding; for I asked that better food might be given to a cow, and I would examine the milk at the end of a week, which I did, and found it equal to the Society's standard.

The following are a few examples of milk bought from farmers in the streets, and milk supplied by the farmers' cows milked in my presence:—

	Milk bought from farmers in the street—						Milk from same farmers cows—					
	1	2	3	4	5	6	1	2	3	4	5	6
Specific Gr.	1026	1025	1028	1028	1027	1024	1032	1033	1033	1034	1033	1034
Total solids	12·10	12·34	11·65	10·47	10·40	10·0	13 76	13·22	13·50	13·50	13·63	12·92
Solids not fat	8·06	8·40	8·50	7·32	7·81	7·3	9·56	9·52	9·60	9·39	9·80	9·72
Fat	4·04	3·94	3·15	3·15	2·59	2·7	4·20	3·70	3·90	4·11	3·80	3·20

In each of the above cases, a summons was issued against the farmer, and a conviction obtained.

In numbers one and two I should have hesitated to declare the milk adulterated unless I had visited the farms.

I think there is little doubt that when a milk only yields 11·5 per cent of total solids it has been tampered with, and such a case should be thoroughly investigated by the analyst.

In the discussion on the two papers on milk analysis, by Messrs. Dyer and Carter Bell, Dr. Muter said it was the old story, viz., that cows were occasionally met with whose milk gave startling results; but there were a great number of other cows which did not, and a little of their milk mixed with the others—for it was not with the milk of one cow alone they had to deal—would soon raise the low figure. He wished Mr. Dyer had given the ash, and hoped it would be added to the paper before it was published. He always liked to see the ash, because he had found that where the ash was taken it was a good guide—a much better guide than many analysts thought—and the ash corresponded with the solids not fat to such an extent that any analyst who was desirous of checking the work of his assistant could do so very well by those two determinations alone. As regards a standard Dr. Muter did not think the Society's standard had been at all affected, because it was an open question whether to starve a cow was not simply another way of adulterating the milk. It they were to go round England and milk one thousand cows, and tabulate the analyses, and take only those in which the solids not fat, fat, and the ash, agreed—rejecting those analyses in which either were only a point or two out—he ventured to say that they would not find twenty that would fall below 8·9, and not more than one which would fall below the Society's standard, which he did not think ought to be lower than it was. In conclusion he pointed out the importance of not relying on any one constituent, but of judging on the analytical results as a whole, and disregarding a slight departure from the average of solids not fat if compensated for by an increase in fat itself.

Dr. Dupré said he had repeatedly given certificates in cases where the solids not fat had been 8·6 or 8·5, and the vendors had paid the fines imposed on conviction. He considered the specific gravity of a milk was of much more importance than many analysts seemed to consider. It appeared to him that the specific gravity of some of the milks referred to did not correspond with some of the other figures. His experience was that a milk of over 1030 specific gravity was almost always up to the Society's standard. The specific gravity should always be given. as it was, he thought, the best guide they could have of the correctness of the analysis. Dr. Dupré also thought that no analyses should be published without being duplicated, and also that the process used should always be stated.

Mr. Hehner said there was, undoubtedly, some proof that the solids not fat fell below 9·0 in some cases, and if that figure was a little too high then 2·5 was rather low for the fat. If any alteration was made at all it must not only be in the solids not fat, but the fat must be raised.

Mr. Dyer, in reply, said that very many of his analyses were made in duplicate and some in triplicate. As to the ash, no doubt it was very important, but he thought Dr. Muter went a little too far in saying that, if the ash did not exactly accord, it proved the analysis incorrect, because nature did sometimes vary her operations.

THE WORK DONE BY PUBLIC ANALYSTS UNDER THE SALE OF FOOD AND DRUGS ACTS DURING 1880.

In accordance with the custom we have adopted for several years past, we have prepared forms for collecting these details, and have sent them, we believe, to nearly every Public Analyst in the United Kingdom. We have received a very large number of the returns and are collating them for publication in our May number. If any Public Analysts who have not received these forms will send a post card to the publishers, copies shall be sent to them at once. We shall, however, be glad to have them returned to us as early in the month as possible.

REVIEW.

Report of the Annual Meeting of the British Association at Swansea.

Swansea : Tweney & Co.

This is a handy little reprint of the most important papers read at the Meeting, with notes of the discussions thereon. These notes are well put together and add to the value of the pamphlet.

BAKING POWDERS IN THE UNITED STATES.

From the New York Tribune.

INTERESTING TESTS MADE BY THE GOVERNMENT CHEMIST.

Dr. Edward G. Love, the present Analytical Chemist for the Government of the United States has recently made some interesting experiments as to the comparative value of baking powders. Dr. Love's tests were made to determine what brands are the most economical to use. And as their capacity lies in their leavening power, tests were directed solely to ascertain the available gas of each powder. Dr. Love's report gives the following:

"The prices at which baking powders are sold to consumers I find to be usually 50 cents per pound. I have therefore calculated their relative commercial values according to the volume of gas yielded on a basis of 50 cents cost per pound."

Names of Baking Powder.	Available Gas. Cubic Inches per each ounce Powder	Comparative Worth per Pound.
"Royal" (cream tartar powder)	127·4	50 cts.
"Patapsco" (alum powder)	125·2	49 ,,
"Rumford's" (phosphate) fresh	122·5	48 ,,
,, ,, old	32·7	13 ,,
"Hanford's None Such"	121·6	47¾ ,,
"Redhead's"	117·0	46 ,,
"Charm" (alum powder)	116·9	46 ,,
"Amazon" (alum powder)	111·9	44 ,,
"Cleveland's (short weight ¾ oz.)	110·8	43 ,,
"Czar"	106·8	42 ,,
"Price's Cream"	102·6	40 ,,
"Lewis's" condensed	98·2	38½ ,,
"Andrews' Pearl"	93·2	36¾ ,,
"Hecker's Perfect"	92·5	36 ,,
Bulk Powder	80·5	30 ,,
Bulk Aerated Powder	75·0	29 ,,

Note.—"I regard all alum powders as very unwholesome. Phosphate and tartaric acid powders liberate their gas too freely in process of baking, or under varying climatic changes suffer deterioration."

PRIVATE WELLS OF SOUTHAMPTON.

The following are figures obtained from analysis of a sample of water taken from a private well in Southampton, the water at the time being in daily use for all domestic purposes. It is very remarkable from the enormous amount of saline ammonia present, and is an example of the fearful pollution of which town wells are liable. The water was fairly presentable to the eye and was not unpalatable; the distillate from carbonate of soda smelled strongly ammoniacal, and, of course, gave a strong alkaline reaction. Parts per 100,000 :—

Free NH_3.	Albumd. NH_3.	Nitrates.=N.	Cl.	P_2O_5	Solids.	Per. H.	Total hardness.
5·68	0·0332	1·9026	2·2	v.h. traces	41·7	6·2	14·5

Microscopical examination—Starch grains, paper, animal hairs.

A. Angell.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

WITH this month's issue of the Society's water reports we publish the first instalment of a periodical series of analyses of the water from the sources of supply. It is obvious that as many companies have various different sources of supply—sometimes as many as eight or ten—we cannot at present undertake to publish the reports on all of these monthly; but an occasional analysis of each will throw, we hope, much additional light on the causes of the variations in the character of the water as delivered, and may, in some cases, lead to the condemnation and abandonment of a bad spring or well.

The uniform system of analysis has already been productive of much good in enabling analyses to be more accurately compared; and the Water Committee are now engaged, under the direction of the Society, in amplifying the instructions so as to provide for every detail in the analytical work, and ensure such data as shall enable concurrent opinions to be given in every case.

These amplified instructions will be published in THE ANALYST as rapidly as possible from month to month.

It is not at present in the view of the Committee to introduce any new process; but in order to make the instructions as complete as possible they are considering, and as far as possible testing, any suggestions that may be made with a view to rendering the instructions complete.

PROVINCIAL TOWNS.

Dublin is supplied with water taken from an artificial lake or reservoir about 26 miles distant from the city, and situated in the mountains of the county of Wicklow. It is filtered at the reservoir, but the supply to the city is taken from an uncovered service reservoir, about five miles from the city. It supplies about 335,000 persons, and the consumption is about 30 gallons per head per day.

Edinburgh.—In 1824 water was brought from Crawley springs and Glencone Burn, in the centre valley of the Pentland hills, forming a large compensation reservoir in that valley. This new supply gave an addition of 250 cubic feet a minute, or 2,250,000 gallons a day, or in all 290 feet a minute.

Additional water was brought in from the Barelaw Liston Shields and Blacksprings on the north side of the Pentland, and from additional burn water which required the construction of large reservoirs, chiefly for compensation and the enlargement of Glencone reservoirs. Those works were finished in 1852. This gave an additional supply of 230 cubic feet a minute. There were now seven reservoirs having an aggregate capacity of 174,000,000 cubic feet.

In 1856 an additional supply of spring water was brought in from Colyium and North Liston Shiels on the north side of the Pentland, at the distance of about 14 miles, giving an increase of about 250 cubic feet a minute; and requiring additional compensation storage of 90,000,000 cubic feet.

In 1868 a further supply of spring water was brought from Crosswood also on the north side of the Pentland hills and 20 miles from Edinburgh, making an addition of 125 cubic feet a minute, and requiring a compensation reservoir of about 28,000,000 cubic feet, thus making a total storage of 292,000,000 cubic feet, and a total town supply of about 900 cubic feet a minute, or 8,100,000 gallons a day. The cost of the works up to this time was about £435,000.

The Moorfoot scheme, which has just been introduced, will double the former supply; but at present about 1400 cubic feet a minute, equal to about 12,600,000 gallons a day, from all sources is found sufficient. The works are from 14 to 17 miles south from Edinburgh, and there are two store reservoirs having a capacity of 312,000,000 cubic feet, and two compensation reservoirs, viz., one of 44,000,000 and one of 48,000,000, the latter not yet constructed. Dalkeith and Musselburgh and other neighbouring villages are being supplied from the Edinburgh works.

Leicester is supplied with water from two sources, viz., Thornton and Cropstone. The strata of the watersheds consists chiefly of slate. The storage reservoir at Thornton (11 miles from Leicester) contains about 278,000,000 gallons. The storage reservoir at Cropstone (five miles from Leicester) contains 500,000,000 gallons. The water is filtered. From Thornton it is sent by gravitation in pipes. At Cropstone, after filtration, the water is pumped into service reservoirs, from which the town is supplied by gravitation. The daily consumption is about 3,000,000 gallons, of which half comes from Thornton.

Manchester.—The water used for the supply of Manchester is collected from an area of drainage ground of 19,300 statute acres, at and near Woodhead, a distance of about 18½ miles from the centre of Manchester. There are 10 reservoirs extending between the one at Woodhead which is the second largest and furthest from Manchester, and the one at Gorton which is the nearest to (about four miles from) Manchester. These reservoirs vary in depth from 20 to 72 feet, and hold from 58,000,000 to 1,474,000,000 gallons. The whole of the reservoirs together hold 4,544,000,000 gallons, and one reservoir is in course of construction at Denton, which is calculated to hold 1,860,000,000 gallons. The highest reservoir—which is the one at Woodhead—is 650 feet above the level of the ground at the Manchester Exchange; and the lowest, at Gorton, is 125 feet above that level. The average quantity of water supplied per day during the year 1880 was 17,998,758 gallons. The drainage area at Woodhead from which the water is collected is formed of the lower millstone grit, also called the "Kinder Scout grit." These beds are interlaid with shale beds, and the flat topped summits of the hills are largely covered with peat, which, however, does not extend to the slopes of the valleys.

Newcastle and Gateshead.—The supply is obtained from reservoirs at Whittle Dean, 12 miles distant from Newcastle-upon-Tyne, and at Hallington 22 miles distant. The capacity of these reservoirs is 1,200,000,000 gallons, and the water is obtained from Whittleburn, Pont, Fair Spring, Mootlawburn, Hallowell, Smallburn, and Hallington North, and Eastburns, the total drainage area of these streams being 17,000 acres, chiefly pasture land. The reservoirs at Hallington and Whittle Dean are connected by an open aqueduct and tunnel, 10 miles in length. The water is conveyed by an open aqueduct and tunnel to filter beds at Throckley, five miles from the town, and is thence distributed by 30-inch and 24-inch metal pipes. The supply is by gravitation to a height of about 200 feet, the higher portions of Newcastle being supplied from a reservoir at Fenham into which the water is pumped from a service reservoir at Benwell, while the higher portions of Gateshead are supplied from a reservoir at Carr's Hill, to which the water is raised from a pumping station on Windmill Hills. There is also a pumping station on the river Tyne at North Wylam, from which a supply can be obtained for manufacturing purposes by a separate line of pipes. In addition to these works two reservoirs are being constructed on

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in March, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	c. pale blue	none	1·91	traces	·3500	·0016	0033	none	none	14·8°	4·2°	32·80	satisfactory	Wigner & Harland.
New River	c. f. yellow	none	1·10	traces	·2270	·0028	·0049	·0014	·0973	14·9°	5·0°	21·42	satisfactory	B. Dyer.
East London ..	c. greenh. yellow	none	1·14	traces	·2700	·0023	·0090	none	·0600	17·0°	7·7°	21·70	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	s. yellow	none	1·21	trace	·1160	·0012	·0070	·0022	·1100	17·0°	5·5°	21·28	v. s. mineral deposit	J. Muter.
West Middlesex	f. yellow.	none	·98	traces	·1740	·0003	·0030	·0030	·0920	14·8°	1·2°	20 82	satisfactory	O. Hehner.
Grand Junction	pale yellow	none	1·26	traces	·1768	·0011	·0061	·0081	·1135	14·8°	1·8	20·00	satisfactory	A. Wynter-Blyth.
Lambeth	yellowish	none	1·24	trace	·0980	·0002	·0092	·0067	·1142	15·0°	5·5°	21·56	mnl. mtr. few mvg. orgms.	J. Muter.
Chelsea	greenish yellow	none	1·20	traces	·5300	none	·0050	·0100	·0730	14·0°	3·5°	21·00	satisfactory	A. Dupré.
Birmingham ..	f. yellow green	none	·49	traces	·2540	·0014		·0090	·0470	10·7°	6·3°	19·07	satisfactory	A. Hill.
Bradford	peaty yel. opaque	none	·70	none	none	none	·0012	·0260	·2300	4·2°	3·9°	7·30	satisfactory	F. M. Rimmington.
Brighton	c. p. green blue	none	2·27	traces	·3000	none	·0030	none	none	12·2°	4·1°	21·80	satisfactory	Wigner & Harland.
Bristol	f. green	none	·90	none	·0520	·0005	·0021	·0035	·0190	15·9°	1·5°	22·80	sand, &c.	F. W. Stoddart.
Cambridge	pale blue	none	1·52	h. traces	·4600	·0020	·0024	none	·0014	17·8	5·5°	24·50	satisfactory	J. West-Knights.
Canterbury	c. pale blue	none	1·47	none	·3290	·0005	·0007	·0050	·0290	7·0°	4·7°	11·76	v. s. mineral matter	S. Harvey.
Coventry	s. turbid grnsh.	none	1·12	none	·1650	·0007	·0042	none	·0410	22·1°	7·1°	27·41	s. clay	H. Swete.
Croydon	brght. colourless	none	1·19	trace	·2510	·0035	·0030	none	·0200	15·5°	7·5°	27·40	veget. matter and sand	C. Heisch.
*Croydon	f. greenish	none	1·19	none	·6200	·0010	·0010	none	·0072	15·5	6·5°	23·0	sand, vegetable fibre	C. Heisch.
Derby	v. good	none	·85	none	·2219	trace	none	trace	·0154	13·2°	5·9°	18·20	satisfactory	L. Archbutt.
Doncaster	faint green	none	1·00	none	traces	·0011	·0070	none	·1270	13·0°	9·0°	11·84		A. H. Allen.
Droitwich	blue	none	2·46	none	·2882	·0070	·0350	·0012	·0312	38·2°	5·1°	43·68	satisfactory	H. Swete.
Dublin	s. yellow	none	·99	trace	trace	·0015	·0080	none	·0550	1·3°	1·0°	4·78	veg. debris and infusoria	C. A. Cameron.
Dudley	grnsh. blue tur.	none	1·57	h. trace	·4030	·0014	·0012	·0120	·1210	17·0°	6·8°	26·04	s. vegetable debris	H. Swete.
Edinburgh	f. yellow tinge	none	·72	none	f. trace	·0016	·0048	·0120	·1142	5·7	3 7°	7·76	satisfactory	J. Falconer King.
Exeter	f. yellow	none	·91	trace	·1808	·0018	·0026		·0272	2·9°	2·9°	7 00		F. P. Perkins.
Grantham	p. blue	none	1·08	traces	·7330	·0006	·0014	none	·0172	14 9°	5·5°	23·01	diatoms and ferric oxide	A. Ashby.
Huddersfield ..	brnsh. yel. turb.	slight	·60	trace	none	·0070	·0080	·0100	·0274	2·0°	2·0°	5·70	peaty mttr. movg. orgsm	G. Jarmain.
Hull	good	none	1·33	trace	·2130	·0038	·0031	·0020	·0200	15·4°	3·2°	19·70	satisfactory	J. Baynes.
King's Lynn ..	dirty yellow opaque	dcyd. veget. matter	1·79	h. traces	·6382	·0036	·0077	·0272	·1686	15·9°	5·1°	21·85	bacteria diatoms	W. Johnstone.
Leeds	light brown	none	·49	traces	none	·0005	·0030	·0140	·1204	4·0°	2·9°	5·04	peaty matter	T. Fairley.
Leicester	yellowish	none	1·12	traces	·1550	·0004	·0140	·0040	·1625	8·0°	4·2°	14·62	confervæ dmids. veg. deb.	W. L. Emmerson.

* One sample is from the Upper and one from the Lower part of the town.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in March, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Liverpool	yellow brown	peaty	1·22	traces	·0930	·0008	·0033	·0084	·1400	5·2°	5·0°	9·52	satisfactory	A. Smetham.
Llandrindod ..	blue	none	·82	traces	·0085	none	·0014	·0008	·0125	7·5°	3·0°	11·48	satisfactory	H. Swete.
Maidstone—														
Wtr. Company	v. turbid	none	2·50	traces	1·3520	none	·0035	·0056	·0618	16·1°	6·4°	34·37	satisfactory	M. A. Adams.
Public Conduit	c. colourless	none	2·60	traces	1·1230	none	·0021	·0028	·0196	17·9°	6·7°	37·41	satisfactory	
Manchester....	s. turbid f. yelw.	none	·61	none	none	·0027	·0038	·0107	·0860	1·3°	1·2°	4·69	s. mineral	W. Thomson.
Newcastle-on-Tyne......	s. turbid yellow	none	·91	trace	·0560	·0010	·0080	·0060	·1040	15·2°	5·5°	19·60	satisfactory	J. Pattinson.
Northampton..	blue	none	5·50	trace	·0160	·0014	·0049	·0005	·0350	9·7°	1.2°	11·10	satisfactory	H. Swete.
Norwich	p. grnsh. yellow	none	1·80	traces	·0353	traces	·0061	·0110	·1260	15·5°	4·0°	17·80	satisfactory	W. G. Crook.
Nottingham ..	p. blu. grn. s. op.	slight	1·62	traces	·1580	·0018	·0015	none	none	13·5°	9·6°	17·8	veg debris, mycelium	Wigner & Harland.
Oldham	p. yelw. s. turbd.	none	·82	none	·0122	·0125	·0029	·0170	·1000	3·8°	3·6°	7·11	vegetable debris, sand	C. Estcourt.
Plymouth	grnish. grey s. turbid	veget. mttr.	·88	none	·0180	·0010	·0114	none	·0580	4·0°	4·0°	4·60	vegetable debris	R. Oxland.
Portsmouth ..	turbid	none	1·19	trace	·2130	·0010	·0042	·0065	·0320	15·7°	4·5°	18·93	vegetable debris, diatoms, infusoria	W. J. Sykes.
Reading	clear	none	1·00	none	·1200	·0007	·0042	·0070	·0128	14·3°	4·2°	18·20	satisfactory	J. Shea.
Rugby	clear	none	1·60	trace	·4270	·0056	·0084	·0014	·0070	9 8	9·3°	18·20	a little oxide of iron	A. P. Smith.
Salford	c. s. yellow	none	·80	none	none	·0014	·0035	·0036	·0860	4·0°	3·0°	6 00	satisfactory	J. Carter Bell.
Sevenoaks	c. colourless	none	1.31	trace	·3150	·0011	·0007	·0028	·0101	15·0°	3·9°	19·88	satisfactory	B. Dyer.
Sheffield	brown turbid	none	·50	none	none	·0028	·0049	none	·0750	4·5°	4·5°	5·67		A. H. Allen.
Shrewsbury ..	c. colourless	none	1·31	trace	·4700	·0010	·0010	none	none	21·8°	5·2°	25·00	satisfactory	T. P. Blunt.
Southampton..	f. yellow turbid	none	·99	trace	·1528	·0029	·0138	·0091	·0840	12·5°	4·5°	18·76	veg. deb. dia. desm., &c.	A. Angell.
Stockport	v. s. turbid	none	·88	none	·0276	·0004	·0012	·0010	none	4·2°	3·5°	6·00	satisfactory	C. Estcourt.
Stourbridge ..	blue	none	2·26	trace	·2470	·0028	·0014	·0020	·0725	17·1°	6·1°	31·92	satisfactory	H. Swete.
Stourport	blue green	none	1·13	trace	·0820	·0012	·0014	·0050	·0760	7·4°	1·7°	10·83	sand and clay	
Sunderland....	c. f. blue	none	1·90	trace	·2500	none	·0031	·0050	none	9·6°	3·7°	25·20	vegetable debris	H. J. Yeld.
Swansea	c. yellow	none	1·00	trace	none	·0010	·0012	·0020	·0010	2·5°	2·5°	3·50	satisfactory	W. Morgan.
Warwick	greenish	none	1·19	traces	·3460	·0011	·0028	·0070	·0193	21·4°	12·7°	23·80	satisfactory	A. Bostock Hill.
Whitehaven ..	f. green	none	·87	none	·0138	none	·0021	none	·0030	·4°	·1°	2·20	vegetable debris, diatoms	A. Kitchin.
Wolverhampton	v. turbid	none	1·29	h. trace	·1183	none	·0063	·0054	·1156	12·0°	6·2°	19·88	amorphous veg. deb. amœbæ. diatoms, &c.	E. W. T. Jones.
Worcester	y. brown	slight	1·73	trace	·2190	·0014	·0091	·0280	·1680	17·1°	6·1°	23·52	vegetable debris, sand and clay	H. Swete.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ADDENDUM.—In the NORWICH Water in the March table the Oxygen absorbed in 2 minutes was omitted; it should have been ·0029.

the Swinburn, 24 miles from Newcastle, and are nearly completed; they cover an area of 242 acres and will have storage for 1,100,000,000 gallons, thus bringing the total capacity up to 2,300,000,000 gallons. The works at Swinburn are connected with the reservoir at Hallington by means of a tunnel two miles in length and five feet in diameter. The daily consumption is about 10,000,000 gallons, and the supply constant.

Norwich.—The supply is derived from the river Wensum, which rises at East Rudham and traverses a course of about 40 miles. The filter beds are situate in Heigham, about half a mile from the city, from which it is forced to distributing reservoirs at Lakenham, a height of about 134 feet above the level of the river at Carron Bridge, from whence it can be obtained by gravitation at all parts of the city. The valley through which the river Wensum flows is an agricultural district of about 236 square miles.

Shrewsbury. — The water supply is derived from a spring lying on high ground about two miles from the town and in the midst of fields. Formerly there were nine wells, narrow, and of very ancient construction—they are said to be 300 years old—from which the supply was taken, but a considerable overflow and consequent waste, which much increased with a succession of wet seasons, led to the embanking of the site of the wells, which are now covered by a small lake. The water is conveyed to the town in leaden pipes, upon which it has no action, and is distributed by means of numerous stand-pipes or "conduits," as they are locally termed, placed at short intervals throughout the town.

Mr. J. W. Biggart, of Greenock, has been appointed Public Analyst for the Burgh of Rothesay.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of the Water from the seven deep Chalk Wells of the Kent Water Company. All samples drawn in March, 1881, and furnished by the Company. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine.	Phosphoric Acid.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Bath	c. pale blue	none	1·77	traces	·4200	·0003	·0013	none	·0160	20·8°	5·4°	28·80	satisfactory	Wigner & Harland.
Crayford	c. pale blue	none	1·63	h. traces	·3710	·0020	·0025	none	·0100	17·9°	5·7°	25·80	satisfactory	
Garden Engine	c. pale blue	none	1·77	traces	·4800	·0009	·0018	none	·0210	23·4°	7·4°	33·40	satisfactory	
Orpington	c. pale blue	none	1·20	traces	·4280	·0015	·0025	none	·0080	17·9°	4·0°	22·20	satisfactory	
Plumstead	c. pale blue	none	2·84	none	·4340	traces	·0009	none	·0200	23·3°	9·3°	35·20	satisfactory	
Shortlands	c. pale blue	none	1·20	none	·3080	traces	·0045	none	·0120	17·0°	3·2°	22·00	satisfactory	
Twinswell	c. pale blue	none	1·77	none	·5390	·0039	·0014	none	·0160	21·3°	6·9°	25·40	satisfactory	

NOTE.—Corresponding Tables relating to the supplies of other Companies will be published from month to month as the results can be obtained.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE WATER OF PHILADELPHIA, U.S.A.

To the Editor of "The Analyst."

Dear Sir,—I have watched with much interest the articles on Water Analysis which have from time to time appeared in your journal, and I have been especially pleased by the recently-inaugurated system of comparative reports. I have ventured to request from the Hon. Sec. of the Society of Public Analysts, a copy of the instructions used, and I shall take pleasure in forwarding to your journal some results of examinations of the public water supply of this city, which results may be interesting as coming from a different district. As a preliminary contribution I submit some tests made recently upon samples of water taken from widely separated parts of the city. The greater part of Philadelphia is supplied by the Schuylkill river, a slack-water stream which near the city is from 200 to 400 yards wide, and receives no sewage of any consequence for five miles above the intake point. A smaller district is supplied from the Delaware, a tidal river varying from half-a-mile to one mile in width, and receiving most of the city sewage, but at points below the intake. No system of filtration is adopted, and the two sources of supply mingle at many points. At the time of the analysis both rivers were in a state of freshet from melting ice, and were turbid from minute particles. The total solid residue is lower than usual. All the figures are in grains to the imperial gallon.

	Schuylkill.	Delaware.
Color in 2ft. tube	Dirty yellow.	Dirty yellow.
Smell at 100°F.	None.	Slightly musty.
Total Solids	6·12	4·2
Chlorine	0·33	0·33
Oxygen required at 60°F. in three hours	0·084	0·168
Sediment	Fine siliceous matter with vegetable *debris* and ciliated animalculæ.	Fine siliceous matter with animalculæ, such as are found in decomposing vegetable matter.

Yours truly,

HENRY LEFFMAN, M.D.

920, *Walnut Street, Philadelphia, March 1st*, 1881.

To the Editor of "The Analyst."

Sir,—In communicating the monthly analyses of public water supplies to your valuable paper, would it not be advisable for the analysts to state the *date* on which the samples were taken?

My reason for asking this is, that we who live in Salford believe that the water supplied to us (from the Manchester Corporation Water Works) is the same as that distributed throughout Manchester; but, on comparing the analyses of Manchester and Salford water for January and February, I find that whereas the former shows more chlorine and free and albuminoid ammonia, and less oxygen absorbed, in January than in February, in the Salford water this is reversed, the February supply containing more chlorine and free and albuminoid ammonia, and absorbing less oxygen than that analysed in January. It would therefore appear that the samples were taken at different parts of the month, and if in the case in point the dates of collection had been stated, such a variation in the same water supply might have an additional interest to your readers.

Yours faithfully,

PERCY J. WINSER.

Higher Broughton, Manchester, March 21, 1881.

THE MANUFACTURE OF WOOD ALCOHOL.

The crude wood alcohol, or pyroligneous acid, together with impure acetic acid, wood tar, charcoal and water, forms the first products of the dry distillation of wood. The wood usually employed for this purpose, and affording the best yield of these commercial products are, first, birch, after which come in their respective order of values, beech, elder and oak. The process of distillation is as follows: The wood, carefully seasoned and thoroughly divested of its bark, is placed in suitable charges into iron retorts, similar in shape to those used in coal gas factories, but much larger, and subject to a heat varying from 400° to 500°

Fahrenheit, in furnaces so constructed that the fire surrounds the retort and insures a uniform temperature on all sides. The length of time required for this baking process varies according to the charge of wood placed in the retort, but is generally from six to eight hours. The more slowly the process is conducted, however, the larger is the percentage of wood alcohol afforded and the smaller of acetic acid, as a quick fire destroys the alcohol by evaporation. The best seasoned wood yields the greater percentage of all the commercial products. After the first distillation the liquor expelled from the wood is run off into tubs or evaporating pans, and allowed to stand until the tarry matter rises to the top, which is then skimmed off. The acetic acid is then neutralized by lime, separating it from the pyroligneous acid and forming the commercial acetate of lime. If the two acids are first distilled over, the grey acetate of lime is produced. After the acetic acid is precipitated and neutralized by the lime, the pyroligneous acid, or pyroxylic spirits, is distilled again; the wood alcohol, in a crude, impure form, is evolved from it. Another distillation concentrates it still further, after which it is ready to be sent to the rectifier. The rectifying process frees it from all impurities of a tarry nature and removes all traces of acetic acid, as well as much of the characteristic odour caused by the presence of different volatile substances. It is a secret carefully guarded by the rectifiers, and very few are acquainted with the character or the proportions of the chemicals employed in the process, though the work is done in a still of ordinary appearance.

In one hundred parts of birch wood, properly prepared by seasoning, &c., are found about the following percentages of commercial products: Crude Acetic Acid (containing 9·9 per cent. of glacial acetic acid), 44·5; Tar, 8·6; Charcoal, 24·2; Wood Alcohol, from ·5 to 1·2; Water, from 21·5 to 22·2.

Most of the acetic acid, of all grades, used for manufacturing or pharmaceutical purposes, is made in this way, from the ordinary crude commercial to the concentrated, chemically pure, and glacial acetic acids of the Pharmacopœia. It is also used in the manufacture of the brown and white sugar of lead.—*Oil and Drug News.*

LAW REPORTS.

Heavy Fine for Selling Adulterated Milk:—

At the Huddersfield Police Court, on March 7th, 1881, James Dearnley, a milk dealer, living at Almondbury Bank, was charged on the information of Mr. Kirk, the sanitary inspector, with selling a pint of milk which was not of the quality demanded by the purchaser.—He pleaded guilty.—Mr. Kirk stated that on the 22nd Feb. he asked Mr. Councillor B. Littlewood to purchase for him from the defendant a pint of new milk, which he did, and for which he gave him 1½d. Witness induced the defendant eventually to take a part of the milk, which he was told had been bought in order that it might be analysed by the Borough Analyst. The milk had been analysed, and Mr. Jarmain had given a certificate showing that of butter fat there was 0·86 per cent.; of solids other than fat, 10·2; and of water, 88·94; thus the milk had been impoverished by the removal of 72 per cent. of its butter fat.—The defendant said he sold the milk as he got it; and it was old, and not new milk. Any one buying milk at 1½d. a pint would know that it was not new.—Mr. Kirk said he heard Mr. Littlewood ask if the milk was new, and also heard the defendant say it was.—Mr. Littlewood corroborated this statement.—Defendant denied it and said he asked him how he could expect to have new milk at 1½d. a pint.—Mr. Kirk told the Bench that defendant said that after the purchase was completed.—Defendant said the price of new milk was 2d. a pint, and in his eagerness to catch him Mr Littlewood asked for a halfpenny out of the 2d., and he gave it to him.—Mr. Littlewood said he asked for the halfpenny because he was informed that new milk was only 3d. a quart.—It was stated that the defendant had been fined twice for a similar offence, once £5 and once £10, but fining seemed to have no deterrent influence on him.—The defendant said he was about to give up the milk business, and he asked the Bench to deal leniently with him.—The Bench said he would have to pay a fine of £15 and the expenses.—Defendant: Is that the lowest you can take?—Mr. Mills (the magistrate's clerk): Can you pay?—Defendant: Yes, sir.

Brandy and Water:—

At the Weymouth Borough Police Court, before the Mayor (Mr. G. Curtis) and Mr. F. Millns, William Henry Banting, landlord of the Globe, High Street, was summoned by Mr. Jno. Hutchins, inspector under the Food and Drugs Act for selling brandy adulterated to the prejudice of the purchaser. Mr. Dickenson (town clerk) prosecuted, and Mr. Travers was for the defence. Mr. Dickenson said it was a bad case, and he asked that a heavy penalty might be inflicted. The evidence showed that according to the analysis made by Mr. Leach, of Sturminster, the Borough Analyst, the brandy was 52½ degrees under proof, being 27½ degrees lower than the law allows it to be sold at. For the defence the wife of the defendant was called, and said she asked the inspector if he would have sixpenny or shilling brandy, and he said sixpenny would do. The Bench: The price could make no difference in the conditions under which spirits could be sold. The only question raised for the defence was whether the inspector had complied with the regulations laid down in the Act at the time he made the purchase, but nothing came of it, and the Bench inflicted a fine of 20s. and costs.

At the Wolverhampton Borough Police Court, Mr. John Ball, provision dealer, Dudley Street, Wolverhampton, was summoned under the Food and Drugs Act, for his wife, as his agent, having sold as butter an article which was not of the nature, substance, and quality of the article demanded, but was, in fact, butterine. Mr. R. J. Lawrence appeared to prosecute on behalf of the Sanitary Committee of the Corporation, and Mr. Rhodes for the defendant. The first witness called was Samuel Blanton, who stated that he was an inspector under the Sale of Food and Drugs Act. On the 16th ult. he went to the defendant's shop, where he saw Mrs. Ball, defendant's wife, whom he asked for a pound of roll butter at 1s. a pound. She gave him a roll, and, paying her, witness told her that he should forward the butter to the analyst. She afterwards stated, "It is butterine, and I told you as I went to the window for it that it is butterine." In reply to Mr. Rhodes, witness said he did not know that fresh butter on the day in question was 1s. 10d. a pound; neither did he know that he had ever bought genuine butter at 1s. per pound. He did not hear Mrs. Ball say the article was butterine as she went to the window. Mr. E. W. T. Jones, the County and Borough Analyst, said the sample that had been given to him only contained 7 per cent. of genuine butter fat, the rest being animal fat. It was an article of the kind largely manufactured under the name of butterine and other names. There was, however, nothing detrimental to health in such a commodity if pure fat was used. Mr. Rhodes said what was now before the Bench was oath against oath, and the defendant's wife was quite as respectable a person as the inspector. She would contradict the evidence of the inspector, and, as a doubt would arise, he should ask that the case be dismissed. Mrs. Ball was afterwards called as a witness for the defence, and stated that when the inspector asked for butter, she told him "that it was butterine." The Bench said that if Mrs. Ball said the words, she said them in such a way as to be inaudible to the inspector. They considered the case proved, and fined the defendant 5s. and costs.

Sampling Milk at Railway Station:—

At Marylebone, Mr. De Rutzen gave his decision in the matter of John Hall, a farmer, of Coventry, for sending up milk to Euston station which was found on analysis by the Public Analyst of St. Pancras to be adulterated. When first before him the summons was dismissed on the ground that the Inspector, in sampling the milk, had not complied with the Act. The Vestry went to the Court of Queen's Bench, and there the decision was reversed, and the case remitted back to the magistrate to impose a penalty. The case has been fully reported in our previous issues.* Mr. De Rutzen now inflicted a fine of 40s. with 12s. 6d. costs.

At Bristol, William Norris, milkseller and dairyman, Peter Street, was charged under a summons that he unlawfully did sell, to the prejudice of Joseph Bruce, the purchaser thereof, as an article of food, a pint of milk, which was a mixed fluid and not of the nature and substance and quality demanded. Mr. Wansborough prosecuted, and Mr. Tonkin appeared for the defendant. Mr. Bruce, inspector, in the employ of the Bristol and West of England Milksellers' and Dairymen's Association, said he went to the defendant's in Peter Street, and asked for a pint of milk. A man named Backhouse, who was behind the counter, supplied him with the quantity required, and witness then informed him that he intended to have it analysed, and gave him a portion of the milk he had purchased, retaining the other himself. He afterwards took the milk to the Public Analyst (Mr. Stoddart), and it was found to contain 10 per cent. of water. A document from Mr. Stoddart was put in by Mr. Wansborough, certifying that the milk in question contained 10 per cent. of water, Mr. Tonkin, on behalf of his client, denied any admixture of water in the milk, and pointed out that the sample was demanded at five o'clock in the afternoon, and was taken from a can of milk which had been standing in the shop since the morning, whereby its quality might have deteriorated. He called Mr. Norris, who stated he was a dairy farmer, living at Whitchurch, and carrying on business in Peter Street as a milkseller. He always superintended the sending away of the milk himself, and was most careful that it went away in a pure state. He served the Grand Hotel, Messrs. Dunlop and Co., and other large firms, and had never had any complaint. Richard Backhouse, in the employ of the defendant, said that the milk given to Mr. Bruce was the identical milk supplied to him in the morning by Mr. Norris. He had not put any water in the milk, and it had been under his supervision all the day. The Magistrates, after a short consultation, said that they had carefully considered the case, and they were of opinion that water had been added. With regard to Mr. Norris, they did not think he was aware that water had been added to the milk, but they had sufficient confidence in their Public Analyst to take his word for it. Mr. Norris, as owner of the milk, was of course responsible, and they should inflict a penalty of 40s. and costs.

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* See Page 11 of this Volume.

Was it Sold as Butter or Butterine?—

Samuel Nelson, provision dealer, Folly Hall, Huddersfield, was charged with selling 1lb. of butter not of the quality required by the purchaser. Mr. Kirk, sanitary inspector, prosecuted, and said the defendant had a stall in the Market. On the 24th ult. he requested William Beaumont (the witness in the last case) to purchase for him, from the defendant's shop, half a pound of cheese, one pound of bacon, and one pound of butter. Beaumont made the purchases; and afterwards he (Mr. Kirk) went into the shop and said that the butter was bought for analysis, and asked the defendant's wife if she desired to retain a part of it. She said she had sold it for butterine. but he reminded her that she had told Beaumont that it was good butter. Mr. Nelson then entered the shop, and said "Yes, she did sell it as butterine." Witness asked him who he was, and he said he was the woman's husband. He then inquired of him how he knew that it was sold for butterine when he was not in the shop at the time. The butter was submitted to analysis, and the report of Mr. George Jarmain stated that the sample was made up of fat other than butter fat—it was butterine, and had undergone no change in its composition. Beaumont gave corroborative evidence. He said Mrs. Nelson told him that it was good butter, but when he told her it was for Mr. Kirk she said "I have sold you that for butterine." Mr. J. D. Liversedge, a clerk in the sanitary office, said on Christmas Eve he was near the defendant's shop, and heard what took place. Beaumont obtained the cheese and bacon, and then asked for the butter. When she was wrapping it up she told him (Beaumont) that it was very good butter; but when told that it was for Mr. Kirk, she said she had sold it for butterine. Mrs. Nelson asked how she could sell it for butter when the word "butterine" was on the box from which she took it? She said she pointed this out to Mr. Kirk, who said it was not sufficient, and he now told the Bench that the word was not in continuation, but that the termination "ine" was in small letters, and underneath the word "butter." He asserted that it was a piece of deception; but this was denied by the defendant, who called John Kershaw, a neighbour, as a witness. He said that on the day in question he was called by the defendant to his shop, and asked him what the letters on the box spelt, and he said "butterine."—The Mayor said the Bench were of opinion that the case was proved, and the defendant would be fined £5 and costs.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
2666	G. W. Davey	Distillation of Coal Tar	6d.
2914	R Neale	Chemicals for Purifying Vitiated Air	6d.
3170	Ditto	Application of Chemicals for Purifying Vitiated Air	2d.
3025	P. Jensen	Electric Lighting	6d.
3155	W. E. and J. W. Hazlehurst	Manufacture of Artificial Manure	2d.
3201	F. J. Cheesebrough	Manufacture of Aqua Ammonia	6d.
3218	J. Imray	Distilling Hydrocarbons from Coal Shale, &c.	2d.
3248	A. Specht	Carburetting Coal Gases	4d.
3264	H. Springmann	Application of Gravel, &c., to the Refining of Sugar	4d.
3330	J. H. Johnson	Preparation of Cinnamic Acid	4d.
3340	G. Wischin	Distillating of Anthracene from Coal Tar	2d.
3361	A. Sauvee	Refining Sugar	2d.
3366	W. R. Lake	Obtaining Starchy and Glutinous Matters from Indian Corn or Maize	

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; British Association Report of Annual Meeting at Swansea (Swansea, Tweney & Co.); Milk and its Analysis, Gibbons (Manchester, Ireland & Co.); Country Brewers' Gazette.

THE ANALYST

MAY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The Meeting appointed to take place on the 13th April was postponed on account of the Easter holidays, and will now be held at Burlington House on Wednesday, May 11th, at 8 o'clock. Among the papers to be read are one by Dr. Alfred Hill, on Some Tea Analyses, and two by Mr. Allen, on the Isolation of Strychnine, and the Assay of Oils.

RESULTS OF ANALYSES OF THE MILK OF FORTY-TWO COWS.

By Charles A. Cameron, M.D., Professor of Chemistry, Royal College of Surgeons; Lecturer on Chemistry and Geology, Government Agricultural Institution, Glasnevin.

During the winter quarter of 1880 analyses were made of the milk of forty-two cows kept at the Government Agricultural Institution, Glasnevin, Co. Dublin.

The morning's milk and the evening's milk of each cow were each analysed once; and an examination of the mixed milk of the forty-two cows was also made on the 11th December, 1880.

The cows, it may be mentioned, were good animals: they had from one to three crosses of the shorthorn breed. They were in the house during the period of the experiments. Their food consisted of a daily allowance of from 8 to 10 stones of pulped mangolds and turnips, and exhausted grain from the brewery, together with from ½ to 1½ stones of hay. They were, therefore, liberally fed.

The results obtained are sufficiently numerous to warrant some conclusions being deduced from them in reference to the average composition of cows' milk and the limits of variability in the proportions of the different ingredients. Some conclusions may also be drawn, but with greater reserve, from them as to the influence of age and period of lactation upon the composition of the milk.

INFLUENCE OF AGE UPON THE QUALITY OF THE MILK.

The ages of the cows ranged from four years to nine years inclusive. If we take two groups—(1st) those aged four years and five years, and (2nd) those aged eight years and nine years—we shall find a great difference in favour of the milk of the latter, both in quantity and quality.

The eighteen cows composing the first group were on the average giving milk during three months: the average yield from each cow was 9¾ quarts—their morning's milk contained on the average 12·97 per cent. of solid matter, and their evening's milk 13·58 per cent. of solid matter. On the other hand, twelve cows, aged eight years and nine years inclusive, on the average in their fifth month of lactation yielded 10½ quarts of milk daily, containing in the morning 13·89 per cent. of solid matters, and in the evening 13·96 per cent. The richest specimen of milk, save one, was yielded by a cow eight years old, and in the tenth month of lactation. She only, however, gave 6 quarts of milk the day on which a specimen of it was taken for analysis. There were only four cows aged four years, and the average composition of their milk was—

Solids	12·245 per cent.
Water	87·755 „
	100·000

Their average yield of milk was 11¼ quarts.

The superiority of the old cows in giving more and better milk may in part be due to the fact that it is only good milch cows that are, as a rule, kept in the dairy several years; the young cows that give poor milk are often put into the stall to fatten.

INFLUENCE OF PERIOD OF LACTATION ON THE QUALITY OF MILK.

The belief that milk becomes deteriorated in quality towards the end of lactation is not supported by the results obtained by these experiments, so far as they go. Eleven of the forty-two cows were giving milk from eight to ten months; the average yield of their milk was 6¾ quarts, which was much below the average yield of all the forty-two cows. The total solid matter in their morning's milk was 13·57 per cent., and in their evening's milk 13·96 per cent.

At an advanced period of lactation the milk becomes scanty in quantity, but its quality—at least, as shown in the cases of the eleven cows in question—becomes, on the whole, improved.

Six cows were giving milk for periods less than one month. They yielded 13 quarts daily each on the average. The solid matters in their morning's milk were 12·70 per cent., and in their evening's milk 13 21 per cent.

Eleven of the cows were giving milk from one to two months. They furnished on the average 11½ quarts per diem. The solid matters in their morning's milk amounted to 13·46 per cent., and in their evening's milk to 14·12 per cent.

Five of the cows were giving milk for four months. Their yield was on the average 10½ quarts daily. The total solids in the morning's milk amounted to 12·196 per cent., and in the evening's milk to 13·456 per cent.

In the following table the amount of solids in each case is shown:—

Cows giving milk.	Qts. yielded per day.	Per cent. of solids in morning's milk.	Per cent. of solids in evening's milk.
Less than one month	13 ..	.. 12·700 ..	.. 13·210
During one month to two months .	11½ ..	.. 13·460 ..	.. 14·120
During four months	10½ ..	.. 12·196 ..	.. 13·456
During eight to ten months inclusive ..	6¾ ..	.. 13·570 ..	.. 13·960

DIFFERENCE BETWEEN THE QUANTITIES YIELDED IN THE MORNING AND EVENING.

In every instance the quantity of milk yielded in the morning exceeded the proportion furnished in the evening. In two instances the morning's supply was three times more abundant, and in very many cases twice as plentiful. About eight hours intervened between the two milkings.

SUPERIORITY OF THE EVENING'S MILK.

Thirty out of the forty-two cows gave richer milk in the evening than in the morning, and eleven cows gave richer milk in the morning than in the evening, whilst the remaining cow's milk was equally good at both milkings. The average amount of solids in the morning's milk was 13·20, and the evening's milk 13·74—a difference of 0·54 per cent. The increase in the amount of solid matters in the evening's milk was due chiefly to the larger amount of fats contained in the latter. The amount was 4·22 or 0·4 per cent. over the proportion (3·82 per cent.) found in the morning's milk. In the case of the mixed milk of the forty-two cows, that yielded in the evening was richer by ·56 per cent. of solid matters, including 0·44 per cent. of fats.

AVERAGE COMPOSITION OF MILK.

The results of the analyses of the milk of these forty-two cows show that the mixed milk of well-fed cows in houses, in the last quarter of the year, contains, when poorest—*i.e.*, in the morning—13·90 per. cent. of solid matter, including 4·20 per cent. of fats. On the 2nd November, the mixed milk of eight cows, which happened to be in the same house, was analysed. One hundred parts contained—

Total solid matters	13·90 per cent.
Solids *minus* fats	9·75 ,,
Fats	4·15 ,,
Ash	0·72 ,,

The Society of Public Analysts of Great Britain and Ireland have adopted, as a standard for the poorest pure milk, 9 per cent. of solids *minus* fats and 2·5 per cent. of fats—a total of 11·5 per cent. of solids. There is little doubt that milk containing less than 11·5 per cent. of solids is watered or skimmed. Still, the results of the analyses of the milk of the Glasnevin cows prove that the milk of an individual cow may contain less than 9·5 per cent. of solids *minus* fats. In twenty-five instances the solids *minus* fats were less than 9 per cent. So far as house-fed cattle in Ireland are concerned, 9 per cent. of solids *minus* fats should be reduced to 8·5 per cent. At the same time, if the milk be the mixed product of several cows, say eight and upwards, then 9 per cent. would be a fair proportion to expect. In the mixed milk (morning's) of the forty-two cows the solid matter *minus* fats was 0·7 per cent. above the standard figure 9, whilst the average of the forty-two analyses of the morning's milk gave only an excess of 0·38 per cent. above the standard proportion.

With respect to the amount of fats, I think 2·5 per cent. rather low: I am disposed to believe that it should be raised to 2·75. In the morning's milk the maximum amount of fat was 5·40 per cent., and the minimum proportion was 2·88 per cent. In the evening's milk the maximum amount was 6·30 per cent., and the minimum 2·69 per cent. The average percentage of fat in the mixed milk of the cows was 4·20 in the morning's and 4·62 in the evening's. Thus it will be seen that, whilst in twenty-five instances the solids *minus* fats fell below the Society's standard, in no instance did the fats fall so low as the Society's standard.

The percentage of total solid matter in the morning's milk varied from 15·50 to 11·44, and in the evening's milk from 16·80 to 11·50.

The mixed milk of 100 cows kept on the dairy farm of Mr. E. M. Russell, Pery Square, was found to contain at the evening's milking 13·85 per cent of solid, including 4·60 per cent. of fats, and 0·72 per cent. of ash. The solids *minus* fats were 9·25 per cent. The analysis was made in March, 1881.

The percentage of solids *minus* fats varied in the morning's milk from 11·78 to 8·25, and in the evening's milk from 11·30 to 8·27.

The suggestion has often been made that a standard for milk should be defined by statute. Perhaps it would be advisable to institute two standards. One might be for solids *minus* fats 8·5, and for fats 2·7 per cent. Any person selling milk below this quality should not be entitled to any defence on the ground of natural poverty of the milk. Another and general standard might be solids *minus* fats 9 per cent., fats 3 per cent. It would be open to persons charged with having sold milk below this standard to prove that it was procured from a very limited number of cows; or they might demand that the cows should be milked in the presence of a responsible person, and a sample of the milk so obtained analysed.

A milk vendor who was prosecuted for selling milk which I certified was adulterated, protested in court that it was pure, but that it was procured from four cows known to yield a very poor milk. I suggested that the cows should be milked in the presence of an officer of the court, and the milk analysed. I found that it contained 13·20 per cent of solids, including 3·5 per cent. of fats. The milk was also analysed by the Inland Revenue Chemists, Somerset House, and with identical results. They further stated that it would be necessary to add 22 per cent. of water to it in order to reduce the amount of solids *minus* fats in it, to that present in the alleged adulterated sample which was also analysed at Somerset House.

I think there is the strongest proof that milk on the average contains more than 13 per cent. of solid matters. During the last sixteen years I have examined an immense number of specimens of this liquid, and whenever I was certain that it was pure, I invariably found it to contain more than 12 per cent. of solids. I am quite satisfied that the milk of Dublin dairy herds contains from 13 to 15 per cent. of solids.

METHOD OF ANALYSIS.

10 grammes of the milk were kept in a shallow capsule in the water bath at 212 deg. F. until thoroughly desiccated; the residue showed the amount of total solid matters. The 10 grammes, dried and pulverised, were boiled in about 80 cubic centimetres of ether for several hours, an upright condenser being placed over the flask containing the ether to prevent a waste of the latter. The ether containing the milk fats in solution was filtered (a very small piece of filtering paper being used) into a light tared flask. The ether was distilled off, and the last traces got rid of by passing a current of hot dry air through the flask and condenser. The flask and its fatty contents were then weighed. The amount of the ash was determined by igniting at a low temperature in a platinum dish, the residue obtained by evaporating 10 grammes of the milk to dryness.

It is perhaps, in part, owing to the great care taken to extract every particle of the fat that such high percentages of that ingredient were obtained.

In every instance the amount of solids was determined by two independent experiments. Many of the weighings of the fats and ash were repeated.

SWEDISH LAWS REGULATING THE SALE OF POISONS.

By C. Heisch, F.C.S., F.I.C.

Read before the Society of Public Analysts, on March 16th, 1881.

Having had occasion to examine into the laws affecting the sale of poisons in different countries, I thought it might be of interest to the Society to learn the principal regulations in force in Sweden (where much pains has been taken in the matter by the Board of Health) without wading through three very verbose Decrees in a language not generally "understanded of the people," but which I am fortunate enough to be able to get translated to any extent.

The 1st Decree bears date January 6th, 1876, and concerns "the Sale of Arsenic and other poisonous matters."

All through arsenic holds a very prominent place, many of the restrictions applying to it alone. Why this should be it is somewhat difficult to understand.

CLAUSE I.

Enacts that white arsenic, or arsenic acid, shall not be made within the Kingdom without the King's permission, and shall only be imported by a pharmaceutical chemist, or by licensed manufacturers, who require this poisonous ingredient.

CLAUSE II.

Section 1 enacts that a pharmaceutist wishing to import arsenic must give notice to the Board of Health, and a manufacturer to the Board of Trade, and obtain a certificate addressed to the Custom House at which the arsenic is to be received, stating where it is to be stored and what quantity the applicant may import, such certificate to be null and void after three months.

Section 2.—Custom House to keep proper record of every importation, and report to Boards of Health and Trade every year.

CLAUSE III.

Only principals or qualified managers of druggists' shops to be allowed to sell arsenic.

CLAUSE IV.

Arsenic not to be sold by pharmaceutist himself, except as follows:—

(*a*) On a recently issued prescription of a qualified medical man, dentist, or veterinary surgeon. Buyer to give receipt to seller stating what he has bought.

(*b*) Qualified manager may act in absence of principal.

(*c*) On a written requisition to a particular druggist, stating quantity and purpose for which required, duly signed. Or arsenic may be delivered to a known scientific chemist, or to a manufacturer who requires it in his business; but either must produce a warrant from a magistrate or a Crown bailiff, not more than a year and a day old. Buyer to sign an undertaking to use all proper precautions in storing the poisons, and not to part with any to anyone. Druggist may refuse to supply if he thinks fit.

Section 2.—Arsenic shall not be sold for destroying rats or vermin or for embalming.

CLAUSE V.

All arsenical preparations delivered according to prescriptions to be officially sealed by the druggist. In all other cases to be in strong glass vessels with proper stoppers, or in strong and securely fastened wooden vessels, sealed by the druggist, and labelled with name of druggist, time of delivery, name of preparation, and the word poison.

CLAUSE VI.

Druggists keeping arsenic to undertake to keep it in such vessels as in V., and under lock and key; no one to have access thereto except druggist himself or his sworn agent.

CLAUSE VII.

Arsenic only to be transported in similar cases, labelled with names of consignor and consignee, quantity, &c.

CLAUSE VIII.

Druggist to keep arsenic book, paged: to be submitted to a magistrate and signed by him before any entry is made, and he (the magistrate) shall state number of pages at date of delivery. Arsenic book to be delivered to magistrate when full, and by him kept 10 years.

CLAUSE IX.

All prescriptions and orders on which arsenic has been sold to be attached to arsenic book and kept with it.

CLAUSE X.

Authorized professional men to inspect arsenic book periodically and report to Board of Trade. Magistrate of county to inspect all stocks of arsenic at least once a year, and compare with books and report result of inspection.

CLAUSE XI.

All persons wishing to manufacture any poisonous article must hold a certificate from one of the Universities, the Medico-Chirurgical Institute, or the Technical School.

CLAUSE XII.

Poisonous articles, other than arsenic, only to be sold by—(*a*) Principals of Drug Stores; (*b*) Pharmaceutical Chemists. All rules for sale of arsenic to apply to other poisons. All scales, weights, scoops, &c., used in weighing or measuring any poison, to be kept for that purpose alone. Poisons to be kept in a separate room to which no one but principal or sworn manager has access.

CLAUSE XVII.

Strychnine or any preparation thereof only to be allowed for killing vermin, under special permit, to be granted by Crown Inspector, if he deem the circumstances to warrant it. Such permit to state all particulars and length of time it may remain in force.

CLAUSE XVIII.

Children's toys not to be painted with poisonous water colours. Colour boxes not to be sold containing poisonous colours unless provided with prominent label stating the fact.

CLAUSE XIX.

No poisonous colours to be used in eatables of any kind. Board of Health to publish list of colours that may be used for this purpose. No leaden moulds or papers prepared with lead to be used by pastrycooks for preparing or wrapping their goods.

CLAUSE XX.

Paper hangings, roller blinds, textile fabrics, artificial flowers, or other goods in water colour, not to contain arsenic. Lamp shades, wafers, stearine or other candles, not to contain arsenic or other poisonous matter.

PENALTIES.

For importing arsenic otherwise than as directed, 200 to 1000 crowns, and forfeiture of goods.

For manufacturing poisonous wares without a license, 100 to 500 crowns.

Any manufacturer having a license infringing any one of the rules, 50 to 500 crowns.

Selling without a license, 100 to 500 crowns.

Infringement of rules for selling, 50 to 500 crowns.

If infringement be made by an apothecary's sworn assistant, master not to be liable.

All other infringement of rules, 25 to 100 crowns.

All Customs' servants, railway officials, &c, to watch over import or transport of poisonous matters, and report same to authorities, or Customs' servants may seize such goods.

Commissioners of Public Health to watch for infringements, and if they see any carelessness in keeping or selling poisons by licensed persons, are to admonish, and, on second offence, report to police.

Any poisons seized to be sealed and kept till it is decided in a court of law what is to be done with them. Notice of seizure to be given to Chief of Police.

Any person being in legal possession of arsenic and wishing to get rid of the responsibility may hand it over to the nearest apothecary, who shall take charge of it as if it were his own, provided the weight does not exceed ten pounds: if above this weight it must be handed to Crown bailiff.

One copy of this Decree, and also of the Proclamation, to be issued by Board of Health, to be accessible at every apothecary's and manufacturer's, or the house of anyone licensed to sell or keep poisons, under penalty of 10 to 50 crowns. Fines to be divided as follows:—One-third to the Crown, two-thirds to Public Prosecutor. If information be given by a private individual then he and Public Prosecutor divide this two-thirds between them.

To take effect after July 1st, 1876.

(To be continued.)

ON THE WORK DONE BY PUBLIC ANALYSTS DURING 1880 UNDER THE SALE OF FOOD AND DRUGS ACTS.

(Compiled from Returns furnished by the Members of the Society of Public Analysts and others).

By G. W. Wigner, Joint Hon. Sec. of the Society of Public Analysts.

The Members of the Society of Public Analysts, and a few of the other Public Analysts who are yet outside the ranks of the Society, have again furnished us with the results of their work in detecting adulteration during the past year, and it is now my duty, for the fifth time, to summarise this work.

The Blue Books, which contain the national returns on the subject, are necessarily delayed until a later period of the year, and they give what, from our point of view, is considered somewhat scanty details in regard to the distribution of the samples in different districts, and in the hands of different analysts. Adulteration is essentially a crime, and as such it is our desire to point it out and show its extent in such a way that the discredit attaching to it shall not be unjustly placed on any particular class of traders, or on any particular district, but that each shall bear the responsibility in proper proportion. These yearly summaries have for this reason been compiled in such a manner as to show in what particular line of business adulteration is most rampant.

The importance of these returns increases each year, because most civilized countries are following the example of England in passing laws for repressing adulteration. No nation has, however, up to the present time, taken any step in advance of us, although several are following closely on our lines.

During this transition stage, exaggerated statements in reference to the prevalence of adulteration, and the small amount of good which has been effected by our English laws, are being published by persons who have had insufficient practical acquaintance with the subject, and the only way to prevent false inferences being drawn is to take care that accurate and reliable statistics are readily available for those who may need them.

These statistics, unfortunately, prove that our legislation on the subject is not yet perfect, but, on the contrary, that the rate of adulteration prevailing now, although a vast improvement upon the condition of things prior to the passing of our Acts, does not show a continued decrease, and although we may stand better in this respect than some other European countries the amount of fraud disclosed is much greater than should be the case.

Nor is the reason far to seek. The total number of official samples analysed in the year is but little more than one for every two thousand of the population, and probably not more than one sample out of every million articles purchased is submitted to any proper and reliable scientific test. It is no wonder, then, that repression has at present failed to effect all the good it was expected to do, but wonder should rather be expressed that such marked results have already been obtained.

The numbers of returns received by us of samples analysed and reported upon during the last six years have been as follows:—

Year.	Districts.	Samples Examined.	Samples Adulterated.	Percentage Adulterated.
1875-6	109	15989	2895	18·10
1877	127	11943	2371	17·70
1878	168	15107	2505	16·58
1879	212	17574	3032	17·25
1880	237	17919	3132	17·47

Once more, therefore, 1880 follows 1879 in showing an increase in the percentage of adulteration. Since no reason for this is apparent, it will be well, as in previous years, to trace this percentage as it exists in reference to each class of samples.

I will first consider the number of samples purchased by the Inspectors and submitted to the Public Analysts. The total of 17,919 shown in the table necessarily includes waters—not because these are strictly under the Act, but because, in some cases, they become mixed up in the returns. The articles purchased have been divided into various classes, as follows:—

Samples Purchased, 1879 and 1880.

	Numbers.		Percentage.	
	1879.	1880.	1879.	1880.
Milk	6036	7251	36·1	40·40
Butter	969	892	5·7	4·97
Groceries	4197	3845	25·0	21·48
Drugs	615	390	3·6	2·17
Wines, Spirits, and Beer	1615	2220	9·7	12·36
Bread and Flour	1471	1326	8·7	7·40
Water	1240	1604	7·5	9·04
Sundries	629	391	3·7	2·18
	16,772	17,919	100·0	100·00

The adulterated samples, 3132 in number, are divided in the following proportions, the results for the year 1879 being appended, as before, for comparison. The percentages are calculated on the total number of samples found to be adulterated in each year.

SAMPLES FOUND ADULTERATED, OR IN THE CASE OF WATERS, UNFIT TO DRINK, 1879 AND 1880.

	Numbers.		Percentage.	
	1879.	1880.	1879.	1880.
Milk	1332	1595	44·72	50·98
Butter	135	179	4·53	5·73
Groceries	492	402	16·52	12·90
Drugs	164	79	5·52	2·52
Wines, Spirits, and Beer	457	480	15·36	15·18
Bread and Flour	68	84	2·28	2 68
Waters	266	287	8·93	9 18
Sundries	64	26	2·14	·83
	2978	3132	100·00	100 00

It is important to observe how the percentages of adulteration stand as compared with previous years when each percentage is calculated on its own class of samples and not on the general total of samples analysed.

PERCENTAGES OF ADULTERATION FOUND FROM 1877 TO 1880, CALCULATED ON THE NUMBER OF SAMPLES OF EACH CLASS ANALYSED.

	1877.	1878.	1879.	1880.
Milk	26 07	18·38	22·06	22 00
Butter	12·48	13·23	13·93	20·08
Groceries	13·00	12·89	11·73	10·43
Drugs	23·82	35·77	26·66	20·26
Wine, Spirits and Beer	47·00	29·31	28·30	21·81
Bread and Flour	6·84	2·97	4·62	6 33
Water	21·63	14·98	21·45	17·73
Sundries			10·17	6·66

Taking the samples examined in 22 of the Metropolitan Districts by themselves, we find that the total number purchased was 2672, of which 406 or 15·19 per cent. were adulterated.

The samples are divided thus :—

METROPOLITAN DISTRICTS—PERCENTAGE OF ADULTERATION, 1880.

	Examined.	Adulterated.	Percentage.
Milk	1043	276	26·46
Butter	196	40	20·41
Groceries	743	63	8·48
Drugs	116	11	9·40
Wines, Spirits and Beer	164	10	6 09
Bread and Flour	235	6	2·55
Waters	42	0	—
Sundries	114	0	—
	2653	406	Avge. 15·19

Again, taking the returns from 150 of the towns of the Kingdom, we find that 7149 samples have been examined, of which 1279 or 17·87 per cent. were adulterated. These are divided as follows :—

TOWNS IN THE UNITED KINGDOM—PERCENTAGE OF ADULTERATION, 1880.

	Examined.	Adulterated.	Percentage.
Milk	3743	816	21·80
Butter	288	75	26 13
Groceries	1105	75	6·78
Drugs	23	5	21·74
Wines, Spirits, and Beer	459	110	23·97
Bread and Flour	560	38	6·79
Waters	829	128	16·30
Sundries	142	10	6·04
	7149	1279	Avge. 17·87

Again, taking the 65 returns from the counties and divisions of counties we have a total of 8117 samples examined and 1447 adulterated, the total being divided as follows:—

COUNTIES IN THE UNITED KINGDOM—PERCENTAGE OF ADULTERATION, 1880.

	Examined.	Adulterated.	Percentage.
Milk	2465	503	20 40
Butter..	408	64	15 69
Groceries	2044	252	13·15
Drugs	215	83	33·07
Wines, Spirits, and Beer	1597	341	22·10
Bread and Flour	531	40	7·55
Waters	722	148	20·50
Sundries	135	16	11·85
	8117	1447	Avge. 17·84

In order to enable a ready comparison to be made, I will now place side by side the percentages of adulteration as shown to exist in London, the larger towns and the counties respectively, simply premising that 14·9 per cent. of the total samples were purchased in London, 39·9 per cent. in the towns, and 45·3 per cent. in the counties.

METROPOLIS, TOWNS, AND COUNTIES—PERCENTAGE OF ADULTERATION, 1880.

	London.	Large Towns.	Counties.	Whole Country.
Milk	26·46	21·80	20·40	22·00
Butter	20·41	26·13	15·69	20·08
Groceries	8·48	6 78	13·15	10·43
Drugs	9·40	21·74	33·07	20·26
Wines, Spirits, and Beer	6·09	23 97	22·10	21·31
Bread and Flour	2·55	6·79	7·55	6·33
Waters	—	16·30	20·50	17·73
Sundries	—	6·04	11.85	6·66
Average	15·30	17·87	17·84	17·47

It will only be possible to glance comparatively briefly at the indications of these various statistics. Referring first, then, to the general summary of adulteration in the whole country we find that Milk adulteration remains almost stationary, the difference from last year being only ·06 per cent. The adulteration of butter has increased very seriously from 13·93 to 20·08 per cent. It is clear that this very serious increase points to a more systematic substitution of Butterine for Butter in retail sales. This fraudulent substitution is greatly to be regretted, not only because it is an offence, but because it is standing in the way of a fair and proper trial of Butterine under its own name for purposes for which it is suited.

Groceries show 1·30 per cent. less adulteration than in 1879. The adulteration of drugs appears to have decreased in three years from 35·77 per cent. to 26·66 per cent., and is now 20·26 per cent.

There is a diminution of nearly 7 per cent. shown in the adulteration of wines and spirits.

The adulteration of bread and flour shows a most serious increase, the results of the last three years having been 2·97, 4·62 and 6·33 per cent. respectively. The percentage of adulteration as shown has more than doubled in two years.

The serious increase in the adulteration both of bread and flour and of butter, can hardly be due, as was surmised last year, to the improvements in the methods of analysis, for no noteworthy step in advance in reference to either of these classes of samples has been

brought into use during the year. It seems rather to point to the necessity for the purchase of a larger number of samples by the Inspectors.

The new feature which we have introduced into the summary this year by the separation of the London Districts, the large towns and the counties, is deserving of some few words of special notice. London appears still to be the worst part of the Kingdom for milk adulteration; the percentage, which over the entire country was 22·00, rising in the Metropolis itself to 26·46. Even, however, in the counties, where one would suppose watering milk would be less prevalent, the percentage of adulterated samples is 20·40.

Butter does not appear to follow exactly on the same lines as milk, for whereas in London 20·41 per cent. of the samples were found adulterated, the towns show more than 26 per cent., and the counties less than 16 per cent.

In groceries the counties are markedly the worst, the percentage of adulteration reaching 13 per cent. as against 8·48 per cent. in London.

In drugs, again, the county districts appear to suffer greatly. The percentage in London, however. viz., 9 40, appears large, considering the care which is supposed to be taken in the Metropolis in procuring supplies of pure drugs.

When the totals of each class of sample are put together and averaged, we find that there is little to choose between Metropolitan, urban and rural districts, and even in London the average of the whole of the samples purchased shows 15·3 per cent. adulterated.

Of the counties there are 8, where only a very small and insufficient number of samples have been analysed, viz., Denbigh, Montgomery, Shropshire, Waterford, N.R. Yorkshire, Cambridge, Carmarthen, and Northumberland, but in this respect the returns appear to show a slight improvement over last year.

There are 41 towns. viz., Barnsley, Chesterfield, Andover, Beverley, Louth, Glossop, Wenlock, Lancaster, Dumbarton, Richmond (Yorkshire), Ripon, Wakefield, Deal, Dover, Sandwich, Derby, Warwick, Hereford, Lichfield, Blandford, Stirling, Androssan, Stewarton, Arundel, Chichester, Newington, Tenterden, Bury, Southwold, Devonport, Penryn, Durham, Maidenhead, Godalming, Reigate, Bewdley, New Radnor, Droitwich, Birkenhead, and Rutherglen, and two counties, viz., Suffolk and Sutherland, where no work appears to have been done last year under the Act. In 1879 there were 44 towns in the same condition, and 19 of the towns appear in the list for both years, as do also the 2 counties of Suffolk and Sutherland.

It is to be hoped that in every one of these cases the Public Analysts have strictly complied with the Act, and made quarterly reports to the appointing authorities in order that these reports may have been duly forwarded to the Local Government Board, whose attention will thus have been called to such an anomalous state of things. It might also be desirable to draw their attention to this yearly return.

At the Meeting of the Society, on the 11th inst., I hope to be able to remark on some further details in connection with these returns, in order that some points which need consideration may be fully discussed.

LABELS.—We have received specimens of the labels for reagents issued by Messrs Woolley, Sons & Co., for the series required for the examination of the Science and Art Department. The novel feature is that the two series are printed in two different colours, one for general and one for personal use. Under certain circumstances the advantage of this system in preventing admixture of series of bottles is obvious. The labels are clearly printed.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE WATER SUPPLY OF PHILADELPHIA, U.S.A.

To the Editor of "The Analyst."

Dear Sir,—I send herewith the report of the analysis of a sample of water taken from laboratory hydrant on March 31st, 1881.

SCHUYLKILL WATER.

Appearance in 2ft. tube	Very slightly yellow.
Smell at 100°F.	Very feebly musty.
Chlorine	0·27
Phosphoric Acid	None.
Nitrogen as Nitrates and Nitrites	0·500
Oxygen absorbed in two minutes	None.
,, ,, ,, four hours	0·560
Hardness before boiling	4·5
,, after ,,	4·5
Free Ammonia	·0056
Albuminoid Ammonia	·0112
Total Solids	7·03
Sediment	Vegetable debris and siliceous fragments.

The dry residue turns only brown, not black, on heating to redness. The water does not become perceptibly turbid except upon long boiling (4 or 5 hours) when minute mica-like scales are formed. The nitrates were determined by aluminium and caustic soda. The colour and smell are very faint and doubtful.

HENRY LEFFMAN, M.D.

920, *Walnut Street*, *Philadelphia*, *April 4th*, 1881.

ANALYST'S REPORT.

At the Somerset Quarter Sessions, held in the Town Hall, Wells, the report of Dr. Alford, of Taunton, the County Analyst, was presented. He said that during the last quarter he had submitted to him altogether 160 samples of food and drugs. There were 23 of butter, 23 of tea, 9 of mustard, 11 of arrowroot, 4 of pepper, 2 of sugar, 1 of coffee, 2 of jam, 1 of confectionery, 2 of ginger, and 2 of liquorice. Of these the coffee was adulterated with 35 per cent. of chicory, and one of the samples of mustard with 20 per cent. of wheaten flour. Many of the butters were of a very inferior quality, especially the salt butter, and many were rancid. The Chairman (Mr. R. H. Paget, M.P.) said he wished to call the attention of the Court to the large importation of spurious butters which were sold. These, they had every reason to believe, were very extensively imported from America, and found their way to England from that country. They had a name, but they were never openly sold in any market as butterine and oleomargarine, and without any process of conversion they found their way into the English market as butter. If the analysis made showed that these compounds were not what they were represented to be, an offence would be committed under the Adulteration of Food Act by anyone exposing them for sale, and he suggested to the Court that they should call the attention of the chief constable, who was the chief inspector under the Act in that county, to this point, and also call the attention of the County Analyst to it, that they might do their best to protect the consumers from eating these spurious and fictitious compounds. Would the chief constable be good enough to call the attention of the police to the matter? Captain Goold (chief constable) said he would not lose sight of the matter. He then made a communication to the Chairman, which was inaudible to the other occupants of the Court. The Chairman said the Court would be glad to hear that there were only four cases of adulterated goods proved in the course of the quarter, and prosecutions had taken place in those cases, and fines to the extent of £4 7s. 6d. imposed. The subject then dropped.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

OUR readers will observe two slight changes in the headings of the water returns for this month. The chlorine and phosphoric acid returns are now tabulated as "chlorine as chlorides" and "phosphoric acid as phosphates." These changes are made in anticipation of the enlarged instructions for water analysis, the issue of which will commence in the next number of this journal. It is intended that in future the tables should give the analyses of samples drawn at any date between the 15th of one month and the 14th of the next inclusive. Thus the tables published in June will include the analyses of waters supplied between April 15th and May 14th. The dates on which the samples were drawn will also be added to the tables.

ANALYTICAL WORK AT SOMERSET HOUSE.

THE Twenty-Third Report of the Inland Revenue Commissioners has recently been issued, and we take the following extracts from the Report of the Principal of the Laboratory:—

The number of samples examined during the year ended the 31st March, 1880, was 15,113, which is 208 in excess of the previous year.

In addition to the ordinary work of the department we have continued our investigation into the chemical composition of various articles of food, and we hope shortly to publish the results in a form in which they will prove useful to analysts and others. A series of food analyses accurately performed, and of recent date, is an important desideratum, and the want is one which we are endeavouring to supply.

Under the provisions of the Sale of Food and Drugs Act the magistrates have referred 26 samples to us for analysis. These comprised milk, butter, flour, oatmeal, coffee, whisky, and mercurial ointment, and in fifteen of the cases our certificate differed from that of the public analyst. Three of these cases consisted of coffee said to contain an admixture of chicory, and the difference in the nature of the certificates did not depend, as in some cases, upon the results of a chemical analysis, for not only were these results in favour of the genuineness of the samples, but by the microscope alone the absence of chicory could be conclusively shown. Three samples of flour alleged to be adulterated with alum were found to contain a slight excess of alumina probably derived from an earthy impurity, but the results of the analysis showed that the flour in each case was entirely free from alum. A sample of mercurial ointment, which was below the standard of the British Pharmacopœia, was found to agree with what is known in the trade as "mild mercurial ointment," and for the preparation of which a formula was given in the London Pharmacopœia of 1836. Finding this to be the case we reported accordingly, and it afterwards appeared that the article was labelled and sold under its proper designation as "mild mercurial ointment." The sample of whisky was said to consist of ordinary alcohol flavoured, but we found it to be composed of a blend of two kinds of spirits commonly known as "patent" and "pot still" whisky. A notable case of alleged abstraction of cream formed one of the samples of milk recently referred to us. The results of our analysis of the sample were as follows:—

Solids not fat	8·54	per cent.
Fat	2·33	,,
Ash	·71	,,

On these results we reported that we were unable to affirm that cream had been abstracted.

It appears that the magistrates came to the conclusion that it would be better to get

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in April, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine as Chlorides.	Phosphoric Acid as Phosphates.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	c. blue green	none	2·13	trace	·440	none	0033	none	·0098	21·6°	8·5°	33·00	satisfactory	Wigner & Harland.
New River	clear v. f. yellow	none	1·12	traces	·200	·0014	·0021	·0070	·0397	13·4°	2·8°	18·76	satisfactory	B. Dyer.
East London ..	greenish	none	1·26	trace	·250	·0030	·0015	none	·0194	17·6°	4·7°	22·80	veg. debris and fibres	Wigner & Harland.
Southwark & Vauxhall ..	v. slight yellow	none	·96	trace	·140	·0007	·0049	·0045	·0587	14·5°	3·5°	19·60	traces mnl. mtr. & diams.	J. Muter.
West Middlesex	faint yellow	none	1·05	trace	·150	·0012	·0018	none	·0450	14·5°	4·6°	19 60	none	O. Hehner.
Grand Junction	v. p. yellow	none	·96	trace	·110	·0025	·0042	·0052	·0652	13·0°	3·9°	19·98	none	A. Wynter-Blyth.
Lambeth	v. s. yellow	none	1·24	trace	·120	·0007	·0025	none	·0537	15·0°	4·0°	20 50	traces minl. and diatoms	J. Muter.
Chelsea	c. p. green. yelw.	none	1·01	trace	·170	·0014	·0049	·0056	·0672	16·0°	4·0°	19·88	animalculæ and diatoms	A. Dupré.
Bath	c. pale blue	none	·90	none	·150	none	·0001	·0019	·0030	17·0°	5·0°	23·85	none	J. W. Gatehouse.
Birmingham ..	greenish yellow	none	·98	traces	·130	·0020		·0110	·3050	10·3°	4·7°	17·74	vegetable matter	A. Hill.
Bradford	s. peaty yellow	none	·70	none	none	none	·0021	·0300	·1400	8·9°	3·7°	7·80	none	F. M. Rimmington.
Brighton......	c. p. green blue	none	2·13	none	·430	·0025	·0025	none	none	12·3°	4·6°	25·20	trs. veg. deb. & animalculæ	Wigner & Harland.
Bristol........	f. bwn grn. cldy.	none	·68	v. s. trace	·060	none	·0058	·0021	·0130	14·8°	1·2°	20·40	sand diatoms	F. W. Stoddart.
Cambridge	c. pale blue	none	1·47	traces	·510	·0014	·0010	none	·0154	·2°	4·5°	25·20	satisfactory	J. West-Knights.
Canterbury	pale blue	none	1·47	none	·310	·0005	·0007	·0050	·0110	5·0°	4·5°	10 36	traces, mineral	S. Harvey.
Croydon	f. bluish green	none	1·05	trace	·330	0010	·0012	none	·0140	15·5°	5 0°	21·80	no sediment	C. Heisch.
*Croydon	f. bluish green	none	1·19	trace	·360	·0005	·0020	none	·0120	16·0°	6·0°	23 20	no sediment	C. Heisch.
Derby	v. good	none	·90	traces	·110	none	none	none	·0130	10·9°	5·0°	17·29	satisfactory	L. Archbutt.
Dublin	s. yellow	none	.98	trace	traces	·0020	·0080	none	·0450	1·4°	1·0°	4.50	satisfactory	C. A. Cameron.
Edinburgh	slightly brown	none	·72	none	v.s trc.	·0016	·0080	·0128	·1504	4·4°	3 45°	5·04	none	J. Falconer King.
Exeter	f. grnsh. yellow	none	·84	v. s. trace	·180	·0023	·0039		·0546	2·9°	2·9°	7·00		F. P. Perkins.
Grantham	pale blue	none	·91	f. traces	·500	·0022	·0027	none	·0125	15·7°	5·9°	22 37	few diatoms	A. Ashby.
Huddersfield ..	yellow brown	slight	·50	none	·010	·0042	·0056	·0030	·0040	2·0°	2·0°	5·00	peaty mttr. movg. orgsm	G. Jarmain.
Hull..........	good	none	1·40	mere traces	·310	·0030	·0043	·0017	·0190	17·2°	4·0°	29·00	satisfactory	J. Baynes, Jun.
Ipswich	c. colourless	none	2·45	trace	·620	·0028	·0040	none	·0098	23·5°	4·2°	33 75	satisfactory	J. Napier.
King's Lynn ..	dirty milky ylw.	vegetable matter	1·59	h. trace	·430	·0056	·0098	·0437	·1802	14 7°	4·8°	21·14	vegetable debris	W. Johnstone.
Leeds	light brown	none	·62	traces	none	none	·0039	·0110	·0950	3·6°	2·8°	1·76	animalculæ diatoms sand	T. Fairley.
Leicester	v. s. yellow	none	1·33	trace	·130	·0020	·0030	·0035	·0780	7·8°	4·0°	14·80	satisfactory	W. L. Emmerson.
Liverpool	yellowish	peaty	1·02	traces	·070	·0014	·0017	·0084	·1260	4·9°	4·3°	8·96	satisfactory	A. Smetham.

* One sample is from the Upper and one from the Lower part of the town.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in April, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine as Chlorides.	Phosphoric Acid as Phosphates.	Nitrogen as Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen. Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
								2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Maidstone—														
Wtr. Company	clear	none	2·70	traces	·820	none	·0014	·0056	·0171	19·0°	6·8°	34·16	satisfactory	M. A. Adams.
Public Conduit	clear	none	2·30	s. trace	·920	none	·0010	·0028	·0123	20·0°	8·5°	35·80	satisfactory	M. A. Adams.
Manchester....	c. f. yellowish	none	·78	none	none	·0026	·0039	·0107	·0730	1·1°	1·1°	5·10	s. mineral	W. Thomson.
Newark	pale blue	none	1·12	v. f. trace	·020	·0011	·0030	none	·0317	16·5°	10·9°	30·80	moving organisms	A. Ashby.
Newcastle-on-Tyne......	faint yellow	none	·94	s. trace	·050	·0010	·0080	·0060	·0800	16·2°	4·7°	20·70	satisfactory	J. Pattinson.
Norwich	s. green yellow	none	1·70	s. trace	·070	traces	traces	·0018	·0740	13·2°	3·8°	17·60		W. G. Crook.
Nottingham ..	greenish blue	none	2·13	traces	1·590	·0011	·0019	none	none	20·1°	12·5°	28·80	vegetable deb. mycelium	Wigner & Harland.
Oldham	s. turbid yellow	none	·85	h. traces	·030	·0151	·0033	·0008	none	4·2°	3·8°	5·68		C. Estcourt.
Plymouth	colourless	none	·85	none	·400	·0010	·0016	none	·0360	2·8°	2·6°	4·30	none	R. Oxland.
Portsmouth ..	clear	none	1·19	trace	·290	trace	·0081	none	·0518	15·1°	6·0°	17·50		W. J. Sykes.
Reading	f. green yellow	none	·95	s. trace	·120	·0005	·0042	·0060	·0190	11·2°	4·1°	18·00	satisfactory	J. Shea.
Rochdale	pale blue	none	·60	none	·010	·0011	·0021	·0014	·0280	3·5°	1·5°	4·60	satisfactory	T. A. Collinge.
Rotherham....	yellowish	none	1·60	trace	none	·0056	·0011		·0105	13·9°		20·65	satisfactory	A. H. Allen.
Rugby........	v. f. turbid no colour	none	1·69	h. traces	·310	·0028	·0012	·0112	·0210	8·5°	7·8°	11·00	vegetable deb. bacteria	A. P. Smith.
Salford	opaque yellow	none	·70	none	none	·0011	·0056	·0140	·1118	3·0°	2·5°	5·50	oxide of iron	J. Carter Bell.
Sheffield	brownish s. turbid	none	·50	none	none	·0011	·0019	none	·0660	4·8°	4·5°	5·31	satisfactory	A. H. Allen.
Shrewsbury ..	c. colourless	none	1·35	traces	·350	·0005	·0015	none	none	22·1°	4·5°	25·10	none	T. P. Blunt.
Southampton..	green yellow s. turbid	none	·98	trace	·160	·0010	·0070	·0080	·061	15·2°	4·7	19·80	vegetable debris	A. Angell.
Stockport	v. s. turbid yellowish	none	·88	h. traces	·020	·0016	·0012	·0018	·0122	1·5°	3·8°	4·41	peaty matter	C. Estcourt.
Sunderland....	c. colourless	none	2·00	trace	·250	·0021	·0030	·0020	none	9·6°	8·7°	25·00	vegetable debris	H. J. Yeld.
Swansea	s. turbid	none	·90	trace	none	·0007	·0012	·0020	·0035	2·5	2·0°	3·67	earthy matter	W. Morgan.
Whitehaven ..	clear faint green	none	·38	none	·010	none	·0009	none	·0090	·1°	·4	1·82	satisfactory	A. Kitchin.
Wolverhampton	pale yellow	none	1·38	h. traces	·140	none	·0070	·0013	·0688	12·6°	6·7°	21·56	desmids and diatoms	E. W. T. Jones.
Worcester	pale yellow s. turbid	none	3·70	trace	·260	none	·0070	·0081	·0910	17·0°	6·9	24·08	sand and clay	H. Swete.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the March Table, the Oxygen of the RUGBY water absorbed in 2 mins. should have been ·0140, in 4 hours ·0704; and the Oxygen of the STOCKPORT water absorbed in 2 mins. should have been ·0028, in 4 hours ·0092.

another sample of milk from the farm, from the same cow from which the previous sample was supposed to have been taken. A second sample was accordingly obtained by arrangement and analysed by the public analyst who reported that the milk was probably "fore milk," and had been deprived of at least twenty per cent. of its cream. On receipt of this certificate the magistrates thought that some tampering with the cow had taken place, and with the view of removing all possible doubt as to the genuineness of the milk, instructed their Inspector to revisit the farm, without giving the farmer notice of his intended visit, and to procure a sample from the same cow. The Inspector accordingly revisited the farm and obtained another sample of the milk as directed. On this sample being analysed in this department, the amount of fat was found even less than before, while the "solids not fat" and the ash were practically the same. It was, therefore evident that the cow yielded milk of a low quality, and the case is quoted as showing the care which is necessary in reporting upon the analysis of a natural product like milk, the composition of which varies so much.

Complaints having been made as to the quality of the ink supplied for use by the Stationery Office, the subject was referred to us by that department for investigation and report. We found that the ink in use was not a pure nutgall ink, and that it soon became thick and clogged the pen. After numerous experiments we recommended the adoption of an ink made entirely from nutgalls, iron, and gum. Such an ink runs freely from the pen, and although pale when first used it soon deepens on exposure to an intense and permanent black.

The examination of postage and other stamps with reference to the adoption of colouring matters which cannot be tampered with without detection has formed a part of our work during the year. It is well known that the pigment of the old penny postage stamps became hard by age, and that by certain solvents it was possible to remove the obliterating marks and thus render the stamps available for use a second time. In a new contract which was about to be entered into for such stamps it was made essential that they should be surface printed, and that the colouring matter should be what is known as "doubly fugitive." The adoption of the cheaper process of surface printing rendered practicable the use of colouring matters much more fugitive than hitherto. After careful investigation the stamps now in use were adopted, not only for their superiority in fugitiveness of colour, but also in quality of gum and excellence of workmanship.

Forty-seven cases have been attended by the analysts from this department, and penalties amounting in the aggregate to £1,288 10s. have been awarded. A conviction ensued in every case, except one, and in this case the chemical witness was not examined. Two of the cases were heard under the Summary Jurisdiction Act, which came into operation on the 1st of January last, and are interesting as showing penalties of £200 and £2 10s. respectively for practically similar offences. Our experience has, however, as yet been too limited for any general conclusion to be drawn as to the effect which this Act is likely to have upon the security of the revenue.

Twenty-nine examiners have received the usual course of instruction.

Six students completed their course of instruction during the year, and at the final examination by Dr. Frankland four received first class certificates and two second-class certificates, but it is only just to one of the latter to say that his course of study was materially interfered with by serious personal illness.

COFFEE AND CHICORY.

Six samples have been examined, all of which were legally genuine, with the exception of one which contained ground date stones.

BEER.

Under this head, which includes beer and materials used for its adulteration, a very large number of samples have been examined during the year. Several officers, acting frequently upon private information, have visited a large number of publicans in London, and wherever they suspected the existence of fraudulent practices, they took samples for analysis, and it is but just to these officers to say, that, as a rule, the samples were taken with great judgment, and that the analysis in a very large majority of the cases confirmed their suspicions. It is quite evident from the admissions made by the publicans to these officers, and from the results of the examination of these samples, that the addition of sugar to beer prevails very extensively, if not universally, among the publicans in the metropolis. Several publicans were detected twice within the course of a few weeks, while others candidly admitted that it was their usual practice to add a saccharine solution to their beer, and especially to their porter.

Out of a total of 673 samples examined, there were 526 to which sugar had been illegally added, or which consisted of materials intended to be used for the adulteration of beer.

BAKING POWDERS IN THE UNITED STATES.

From the New York Tribune.

ALUM BAKING POWDERS IN COURT. INTERESTING TESTIMONY OF SCIENTIFIC MEN.

Within the past two years a bitter controversy has been waged between manufacturers, on account of the use of alum as a cheap substitute for cream of tartar by many manufacturers of baking powders. The handsome profits yielded by using the substitute have induced dealers as well as manufacturers to push them into the hands of consumers, sometimes under definite brands, frequently by weighing out in bulk without any distinguishing name.

Are such powders wholesome? The Royal Baking Powder Co., who make a cream of tartar baking powder, declared that they are injurious to the public health, while others who make alum powders claim that they are not. The whole matter as to the effects of these alum powders has finally been brought into the courts, and the case was tried in the Superior Court of New York city before Chief Justice Sedgwick, reported substantially as follows in the New York *Sun*.

The suit of Dr Henry A. Mott against Jabez Burns, has brought to light the fact that this country produces at least forty-two different kinds of baking powders. Neither Burns nor Mott has been found guilty of making the baking powders, but Burns, who is the editor of a periodical called the *Spice Mill*, has been severely mulcted for libel in his efforts to make his paper spicy. Dr. Mott, it appears, is a chemist, and was at one time employed by the United States Government to analyse different specimens of baking powder which had been recommended for adoption to the Indian Bureau. Dr. Mott reported in favour of the cream of tartar baking powders for the Indians, and against the alum baking powders. The chemist analysed forty-two kinds of baking powders.

The jury were out about half-an-hour. They came in with a verdict awarding Dr. Mott 8,000 dols., to which the Court made an additional allowance of 150 dols.

As the public have a large interest in the wholesomeness of whatever it is called upon to use as food, the following extracts are introduced from the testimony of some of the prominent men as to the injurious effects of alum powders:—

Dr. Mott: I was employed as chemist by the United States Government to analyse all the articles of food; to express an opinion as to the analysis of their healthfulness and purity. I examined baking powders. It would be difficult to remember them all; I could refer to my books; I examined twenty-eight powders; was given sixteen at first And among the powders included was "Dooley's Baking Powder," the "Charm," and "Patapsco." I found alum in Dooley's, "Patapsco," "Charm," "Queen," "Vienna," "Orient," "Amazon," "Lake Side," "Twin Sisters," "Superlative," "King," "White Lily," "Monarch," "One Spoon," "Regal," "Imperial," "Honest," "Economical," "Excelsior," "Chartres," "Grant's," "Giant." It is my opinion, based upon actual experiments on living animals, that alum in these various compounds, in baking powders such as I have examined, is injurious.

Dr. Charles F. Chandler, called on behalf of the plaintiff, testified as follows:—I reside in the City of New York. My business is that of a chemist. I am, and have been Professor of Chemistry in several colleges. I am at present Professor of Chemistry in the Academic Department of Columbia College; the School of Mines, Columbia College; the New York College of Physicians and Surgeons, and the New York College of Pharmacy. I am President, also, of the Board of Health. I have had frequent occasion to examine the question of wholesomeness of food, and the beneficial or injurious effects of its ingredients. There is an injurious constituent left after the mixture of alum and bicarbonate of soda in a baking powder. I think it is dangerous to the digestive organs, and liable to produce serious disturbance of the liver of the individual making use of such powders.

Henry Morton, President of Stevens Institute, testified as follows:—I am President of Stevens' Institute. I have for many years been a chemist. I have had occasion to examine the substances which are used in the composition of baking powders. Some time ago I examined a sample of Dooley's Baking Powder. It contained potash alum. I did make an extract of that alum, to show the kind. I extracted a large quantity of it as potash alum, and it is in that bottle which I have now here [showing bottle]; that is potash alum which came out of the alum baking powder that was in that can. I took a portion of this powder and mixed it with flour in the directed proportions, and baked a small loaf with it; then I soaked this loaf—the interior part of it—in cold water, and made an extract, in which I readily detected, by the usual tests, alum—that is, alumina in a soluble condition.

Q. Does any baking powder in which any alumina salts enter, contain alumina, in your opinion, which can be absorbed in the process of digestion—are not such objectionable?

A. Very decidedly objectionable, in my opinion.

Q Why do you say—from what system of reasoning do you make it out—that because alum is injurious, alumina is injurious?

A. Because the injurious effects of alumina, when it gets into the stomach and reacts on the organs, are the same; this hydrate of alumina meets in the stomach the gastric juices, and reacts with them the same as alum would; it forms, in fact, a kind of alum in the stomach with those acids, and whatever alum would do, it would do.

Dr. Samuel W. Johnson, Professor of Chemistry in the Scientific School, Yale College, testified as follows:—I have had much to do in the examination of substances that enter into food, and the adulteration of food?

Q. After the use of alum with soda, in a baking powder, in your opinion, is there any injurious substance left?

A. In my opinion, there is an injurious substance left.

Q. What, sir, two years ago, was the prevailing opinion among scientific men, as to the effect of the use of alum in baking powders?

A. As far as my acquaintance with scientific men is concerned, my personal opinion is derived from my investigation and from reading; I should think the opinion was that alum, or any compound of alumina, would be decidedly injurious.

Q. Do I understand you to say that any baking powder in which there are aluminous salts, or any resultant from alum which could be absorbed in digestion, is objectionable and injurious?

A. Extremely so.

Prof. Joseph H. Raymond testified as follows: I am a physician and professor of physiology. I have been for some time Sanitary Superintendent in Brooklyn.

Q. Now, sir, I will ask you your opinion, from this experience, whether the use of alum with soda, in a baking powder, is injurious or not, in its physiological effects?

A. I consider it to be dangerous.

Q. You examined this question for the Board of Health in Brooklyn, some years ago. What was the result of your investigation as to the use of alum in baking powder?

A. The result of my investigation at the time was this: that the changes which took place between the time that alum baking powder was put in the bread, and the time the bread was eaten, the chemical changes were so little understood by chemists, that as a physician and physiologist, I considered it a dangerous experiment.

Dr. Mott, the Government chemist, in his review on the subject in the *Scientific American*, makes special mention of having analysed the Royal Baking Powder, and found it composed of pure and wholesome materials. He also advises the public to avoid purchasing baking powders as sold loose or in bulk, as he found by analyses of many samples that the worst adulterations are practiced in this form. The label and trade mark of a well-known and responsible manufacturer, he adds, is the best protection the public can have.

LAW REPORT.

Recently Mr. Bruce, the stipendiary magistrate at Leeds, gave his decision in a case heard before him in which Superintendent Newhouse summoned Messrs. Wilcock & Son, provision dealers, Kirkgate for selling butterine instead of butter, as asked for by the purchaser. Mr. Bruce said this was an information under the Food and Drugs Act, 1875, charging the defendants, Wilcock & Son, with selling to the prejudice of the purchaser, John Newhouse, an article of food, butterine, which was not of the nature, substance, and quality of the article, butter, demanded by the purchaser. At the close of the complainant's case, Mr. Warren, for the defendants, submitted that certain conditions precedent to a prosecution under the Act had not been complied with, those conditions being contained in Sections 14 and 15 of the Act, which provide that the purchaser shall, after the purchase shall have been completed offer to divide the article into three parts, to be then and there separated, and each part to be marked and sealed, or fastened up in such manner as its nature will permit, and shall, if required to do so, proceed accordingly, and shall deliver one of the parts to the seller or his agent. He shall afterwards retain one of the said parts for future comparison, and submit the third part, if he deems it right to have the article analysed, to the analyst (Section 14). But if the seller or his agent do not accept the offer of the purchaser to divide the article purchased in his presence, the analyst receiving the article for analysis shall divide the same into two parts, and shall seal and fasten up one of those parts, and shall cause it to be delivered either upon the receipt of the sample or when he supplies his certificate to the purchaser, who shall retain the same for production in case proceedings shall afterwards be taken in the matter (Section 15). At the hearing of the information in such proceedings, the articles retained by the person who purchased the article shall be produced (Section 31.) The evidence of Newhouse, the purchaser-in-chief, was, "I said [to the seller], 'I will divide the butter if you wish, and leave a portion with you.' He said, 'Oh, no; it does not matter.'" On cross-examination, he gave this account of the matter:—"I said I would divide it into three portions. I am not sure whether I mentioned three parts. I believe the words I used were, 'I will divide the butter, and leave a portion with you.' I did not say I would mark it or seal it. I did not fasten it up." There was no evidence that Section 15 had been complied with, nor was there any production of articles under Section 21. Upon the statute and the facts Mr. Warren contended—(1) that no offer had been made to the seller by the purchaser in the terms of Section 14; (2) that if such offer had been made, then there was no proof of compliance with the terms of Sections 15 and 3; and (3) that these were conditions precedent to the prosecution, citing Barnes v. Chipp, L. R. 3, Ex. D. 176. On the part of the prosecution, it was urged by the Town Clerk—(1) that the evidence showed that the purchaser had offered to divide the butter and leave a portion with the seller, and that this offer having been refused, it was not necessary for him to offer to divide the article into three parts, each part to be marked and sealed or fastened up; (2) that if a sufficient offer had been made under Section 14, it was not necessary to prove compliance with Section 15, or to produce the article under Section 21; (3) that the procedure under Sections 14 and 15 was only a mode of ascertaining the genuineness of the article, and did not form part of the substance of the offence, citing certain expressions used by Mr. Justice Lush in Horder v. Scott, L. R. 5, Q. B. D. 555, and therefore as the Town Clerk argued, did not require proof. I should have thought, if there had been no authority on the subject, that at the most the objections taken by Mr. Warren were mere objections to receiving the analyst's certificate in evidence, and that that having been put in, I said it was too late to take objections founded on Sections 14 and 15, but in Barnes v. Chipp it was decided that it was a condition precedent to a prosecution under the act that the purchaser should notify to the seller his intention to have the article, not merely analysed, but analysed by the Public Analyst. This requirement as to the notification of intention to have the article analysed by the Public Analyst occurs in the same sentence, and, as it were, in the same breath, with the requirement of the offer to divide into three parts sealed or fastened up. If the one is a condition precedent to the prosecution, it is difficult to imagine any ground on which the other case should be held not to be so. If, then, the offer to divide the article into three parts, to be then and there separated, and each part to be marked and sealed or fastened up in such a manner as its nature will permit, is a condition precedent to the prosecution, was such an offer made in this case? Newhouse, the purchaser, said, "I will divide the butter, and leave a portion with you"; and to this the seller said, "It's no matter; I have plenty here." This offer was certainly not made in the terms of the statute, and I am of opinion that it ought to have been so made. I do not say that every word used in the statue should have been used by the purchaser but there ought to have been an offer by him then and there to separate the article into three portions, and to mark and seal or fasten them up. The words of the statute are plain and simple, and it is the offer prescribed by them which is to be made, and not some other. But supposing the offer made and the refusal of it were sufficient under Section 14, I am of opinion that the provisions of Sections 15 and 16 not having been complied with, no conviction could take place in this case, for a compliance with Section 15 appears to me to be just as much a condition precedent to the prosecution as a compliance with Section 14; and although a compliance with that part of Section 21 which requires that at the hearing of the information the parts of the article retailed by the person who purchased the article shall be produced is not a condition precedent by the prosecution, yet where their non-production is challenged by the defendant, as in this case, it must be a condition precedent to a conviction, otherwise the requirement of their production by the statute would be nugatory. It is quite true, as said by Mr. Justice Lush in Horder *v.* Scott, that the procedure under Sections 14 and 15 do not form part of the substance of the offence; but, in the words of Chief Baron Kelly in Barnes *v.* Chipp, they are conditions precedent to the prosecution. I may observe also, that they are conditions which may easily be complied with. The objections above mentioned were raised by Mr. Warren at the close of the complainant's case, and on the evidence as it then stood. He afterwards relied upon the objection that the article was a perishable one, the defendant having sworn that it was so, and there being no evidence the other way. If the article was perishable, then it was admitted by the Town Clerk that the summons had not been served within the time prescribed by 42 and 43 Vic., c. 30 sec. 10. Unless I were to disregard all the usual rules of evidence I must hold, upon the evidence before me in this case, that the article is perishable, and upon this ground, therefore, the defendant is entitled to success. Some objects were taken by Mr. Warren to the form of the certificate of the analyst. I do not think it necessary to go into those objections excepting to say that the certificate in some points varies from the certificate given in the schedule to the Act, and that it is very desirable that in future cases, in order to avoid any question, it should not do so. Mr. Warren said he understood that the Town Clerk did not propose to go into the case of Robert Palmer, which was similar to that just decided. Mr. Bruce added that he thought the prosecution in this case might be of some value, because it had been shown by Mr. Wilcock's statement, and the statement of the shop-boy, that when a person went into a shop and asked for butter, he was supplied with butterine, which, when kept some time, became rancid.

We are requested to state that the experiments published by us, in our March number, on the Action of Permanganate of Potash, were made by a method suggested by Dr. Duprè, and which we understand he has used for many months.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
3494	St. G. L. Fox	Electric Lamps	6d.
3509	J. Hopkinson	Electric Lamps	2d.
3540	J. Imray	Manufacturer of Sulphuric Acid	2d.
3550	F. A. Bonnefin	Preparing, Evaporating, &c., Saccharine Juices	4d.
3553	C. Weekes	Manufacture of Fuel	2d.
3554	E. Parry & T. H. Cobley	Manufacture of Earthy Silicates	2d.
3584	C. Hessel	Manufacture of Hydrogen, &c.	4d.
3592	W. Ayrton	Treatment of Bituminous Shales, &c.	4d.
3593	J. E. Newry and J. F. Ramsay	Manufacture of Yeast	4d.
3695	J. F. Parker	Manufacture of Gas	4d.
3730	A. Pope	Manufacture of Gas	8d.
3750	G. Wischin	Manufacture of Carbolic Acid	2d.
3771	H. Koenig	Manufacture of White Lead	2d

THE ANALYST

JUNE, 1881.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of the Society was held at Burlington House, on Wednesday, the 11th May. In the absence of the President, Mr. Heisch, the chair was taken by Dr. Dupré, F.R.S.

The minutes of the previous meeting were read and confirmed.

Dr. Vieth and Mr. Carpenter were appointed scrutineers to open the voting papers, and reported that the following gentlemen had been elected as members:—W. L. Emmerson, M.D., &c., Public Analyst for the County of Leicester, &c.; H. Meadows, M.B., Public Analyst for the Borough of Leicester; R. Oxland, F.C.S., Public Analyst for Plymouth and Devonport; W. F. K. Stock, Public Analyst for Durham.

The following gentlemen were proposed as members, and will be ballotted for on the 1st June inst.:—H. Leffman, M.D., Analytical Chemist, of Philadelphia; E. G. Love, Ph.D., Analytical Chemist, of New York.

Mr. Wigner referred to the table in The Analyst for May, and made some further remarks on the work done by Public Analysts during 1880 under the Sale of Food Act.

The following papers were then read and discussed:—

"On the Estimation of Tannin in Tea," by Dr. Alfred Hill.

"Note on the Isolation of Strychnine," and "Note on the Assay of Oils," by A. H. Allen.

It was announced that the next meeting, which had been fixed for the 1st June, had been specially set apart for the consideration of the Scale for the Valuation of Impurities in Drinking Waters, which has been in partial use by some of the Members of the Society who are co operating in the scheme of water analyses, and that the subject would be introduced by a paper by Mr. Wigner.

ESTIMATION OF TANNIN IN TEA.

By Alfred Hill, M.D., F.I.C.

Read before the Society of Public Analysts, on 11th May, 1881.

In examining the later samples of tea which have been submitted to me for analysis, it occurred to me that it would be desirable to ascertain the quantity of tannin present, for although it has been already shown that this constituent of the tea leaf is very variable, and therefore that its quantity, unless large, is of little value as an indication of purity, or, unless very small, furnishes no proof of adulteration, yet a few more observations in the same direction may possibly be productive of some good.

I am not aware that Lowenthal's improved method of tannin estimation has ever been employed in the estimation of tannin in teas, and as its superiority to all other methods as regards expedition, ease and accuracy is testified to by the best authorities, I determined to employ it. It is regarded by Neubauer, Oser, Eitner, Kathreiner, and H. R. Procter, who have all had a large experience with it, and who have all helped to perfect it, as the best process for the estimation of tannin in barks and other similar materials, and it is therefore no doubt also best adapted for estimating the tannin in tea, in which, as in the tanning materials referred to, the tannin is associated with gallic acid and other substances which, like it and tannin, are readily oxidisable.

As some others may wish to use the method, it may perhaps be advantageous to say a few words in explanation of its principle and mode of application, but for fuller details I would refer to the author's original paper in the *Zeitschrift fur Anal Chemie*, 1877, pp. 33 and 201, to a paper by F. Kathreiner, Dingler's *Polyt. Journal*, No. 227, p. 481, and to two excellent papers by Mr. H. R. Procter, in the *Chemical News*, vol. xxxvi., p. 58, and vol. xxxvii., p. 256.

The principle of the process rests on the oxidisability in the cold of tannin and the associated compounds, the separation of the tannin by means of gelatine, salt and acid, and finally the oxidation of the associated compounds minus the tannin. The difference between the two quantities of the solution of potassium permanganate of known strength used in the oxidation processes is that necessary to oxidise the tannin alone.

The following are the solutions required :—

(1.) Solution of potassium permanganate, 1·333 grms per litre.
Of this solution, 24·1 c c.=0·063 grms. oxalic acid.
=0·04157 grms. gallotannic acid (Neubauer).
=0·062355 grms. quercitannic acid (Oser).

(2.) Solution of sulphindigotate of potassium of such strength that 20 c.c. require from, say 9 to 10 c.c. of the permanganate for oxidation.

(3.) Dilute sulphuric acid (1 to 3 water).

(4.) Gelatine solution made as follows: 12·5 grms. good transparent (pale) glue are steeped in cold water all night; the superfluous water is then poured off, and the dish containing the swollen gelatine placed on the water-bath to dissolve or melt the swollen mass, which is then saturated with good table salt and made up to 1 litre with a saturated solution of salt in water.

(5.) A saturated aqueous solution of salt containing either 25 c.c. sulphuric or 50 c.c. hydrochloric acid per litre.

The following is a description of my plan of proceeding:—2 grammes of tea were completely exhausted by boiling with water, and the decoction when cold was made up to 500 c.c., and the titration proceeded with at once in order to obviate any change. If the decoction must be kept even till next day Lowenthal recommends the addition to it of a few drops of glacial acetic acid (or of phosphoric acid).

10 c.c. of the decoction = 0·04 grm. of the tea leaf were taken, diluted with about a litre of water, mixed with 20 c.c of the indigo solution and 10 c.c. of the sulphuric acid solution and the permanganate solution added very slowly and with constant stirring. The completion of the oxidation is recognised, if the titration be performed in a beaker placed on a white ground, by the occurrence of a clear yellow tint, readily hit by a little practice ;

or, when the operation is conducted as recommended by Kathreiner in a white porcelain basin, by the appearance of a faint rose tint at the edge of the yellow liquid.

Having previously prepared another portion of the same decoction by removing from it the tannin, 50 c.c. of it are measured off and titrated with permanganate in precisely the same manner as just described. The mode of preparation is as follows:—100 c.c. of the decoction are mixed with 50 c.c. of the salted gelatine solution, and finally, after well stirring, with 100 c.c. of the salt acid solution. The tannin is thrown down in combination with gelatine, and, after standing several hours or all night, is filtered off: the filtrate should be *perfectly* clear. Care must be taken to mix the tannin solution with the solution of salted gelatine before adding the salt acid solution; because, as Lowenthal especially mentions, acids precipitate, partly at least, the salted gelatine.

The time occupied by the titration of the original decoction should not be less than four minutes, and by that of the filtrate from the tannate of gelatine six minutes, as the presence of gelatine exerts a retarding influence on the reaction.

The following is a transcript from my note book of the results of an actual experiment:—

A.—TANNIN AND OTHER OXIDISABLE MATTERS.

10 c.c. decoction = 0·04 grm. tea ... 20 c.c. indigo solution acidified	required	13·2	c.c. permanganate.
Ditto repeated	„	13·0	„ „
		26·2	
40 c.c. indigo alone, acidified	„	19·8	„ „
20 c.c. = 0·08 grm. tea	„	6·4	„ „

B.—OXIDISABLE MATTERS EXCLUSIVE OF TANNIN.

50 c.c. filtrate = 0·08 grm. tea ... 20 c.c. indigo solution, acidified	required	11·8	c.c. permanganate.
Ditto repeated	„	12·0	„ „
		23·8	
40 c.c. indigo alone, acidified	„	19·8	„ „
100 c.c. = 0·16 grm. tea	„	4·0	„ „

6·4 × 2 = 12·8 c.c.
4·0
8·8 c.c. permanganate required by tannin in 0·16 grm. tea.

8·8 × 0·0026 = 0·02288

$\frac{\cdot 02288}{\cdot 16}$ = ·143 grm. or 14·3 per cent. tannin.

The calculation is based on Rochleder's statement that the peculiar tannin of tea is identical with quercitannic acid, and on the employment of Oser's factor for that acid.

In order to save others trouble I may take this opportunity of pointing out what is evidently an error of inadvertence in the statement following the example quoted from Löwenthal's original monograph by Mr. Procter in the *Chemical News*, vol. xxxvi., pp. 59 and 60, and that Mr. Wynter Blyth, in his *Manual of Practical Chemistry*, has copied the error. Mr. Procter has omitted to divide the figures 9·1 by 2, the result of which is that 10·8 c.c. permanganate are made to appear as equivalent to the tannin of

20 c.c. of the sumach decoction or to 0·2 grm. of dry sumach, whereas the quantity of permanganate required is actually 15·85 c.c.

The last eight samples on the list I obtained from a large importer who gave me the particulars of description, and their genuineness as imported is undoubted.

Green teas as a rule contain more tannin than black teas, but there are many exceptions, as a reference to the list will show, and it is remarkable that the sample of black tea containing the largest quantity of tannin (No. 31) contains more than the richest sample of green (No. 8).

Mulder found 17·8 per cent. in Chinese green tea (Hyson), and 12·88 per cent. in Chinese black tea (Congo); also 17·56 per cent. in Java (Hyson), and 14·8 per cent. in Java (Congo).

The average amount of tannin in the thirty-two samples, the analyses of which I submit, is 14·8. Mulder's results were obtained with dried tea, mine with undried, so that his average results and mine are very similar. Some results obtained by Mr. Wigner, and given in the *Proceedings of the Society of Public Analysts*, vol. i., p. 285, are very much higher than any I obtained, probably because the method of estimation employed was that by acetate of lead, which includes gallic as well as tannic acid.

The amount of tannin in tea is seen not to be in proportion to price, while in astringents used for tanning it is so; the esteem in which a tea is held seems to depend upon qualities appreciable by the taster rather than upon chemical composition as revealed to the chemist. It is desirable that in the examination of teas, as in that of other matters, uniformity of procedure should be observed, so that the results of different experimenters may admit of comparison, which is impossible as long as one uses the gelatine process, another the acetate of lead method, and a third that of Löwenthal. As the latter is now much simplified and is comparatively easy, quick and certain, while it gives the amount of tannin as distinguished from gallic acid, I trust that others will be induced by my own experience of the process to give it a trial when a suitable opportunity shall present.

RESULTS OF TEA ANALYSIS.

Description.	Ash Total.	Ash Soluble.	Ash Insoluble.	Tannin.	Extract.
Mixed	6·06	3·50	2·56	15·93	——
Mixed	5·98	3·78	2·20	16·57	35·5
Black	7·00	3·34	3·66	7·80	28·00
Mixed	6·08	3·64	2·44	11·05	33·25
Mixed	6·69	3·41	3·28	17·55	36·25
Mixed	5·88	3·56	2·32	12·35	34·25
Black	5·77	4·24	1·53	13·65	35·50
Green	6·69	4·20	2·49	24·98	43·00
Black	6·08	3·86	2·22	12·35	33·50
Green	6·06	4·14	1·92	20·80	43·00
Green	5·81	4·01	1·80	24·05	43·75
Black	6·34	3·90	2·44	12·35	34·00
Black	6·21	3·59	2·62	15·02	29·80
Green	5·98	4·34	1·64	21·13	39·00
Black	6·90	3·46	3·44	8·13	26·50
Green	5·92	3·86	2·06	19·60	33·00
Black	6·71	3·05	3·66	10·08	28·75
Green	6·94	3·31	3·63	9·10	25·50
——	6·06	3·52	2·54	15·28	——

Results of Tea Analysis.—*Continued.*

Description.	Ash Total.	Ash Soluble.	Ash Insoluble.	Tannin	Extract.
——	6·50	3·72	2·78	14·30	——
——	5·83	3·05	2·78	8·13	——
——	5·88	3·94	1·94	17·88	——
——	6·08	3·44	2·64	9·10	——
——	6·78	3·50	3·28	14·63	——
Medium Congou, Chinese (Black), cost total 2/0½, June 4th, 1880 ..	5·90	3·44	2·46	6·83	——
Assam (Black), cost total 2/2, June 4th, 1880	5·55	3·18	2·37	6·18	——
Common Chinese Congou (Black), cost total 1/4½, June 4th, 1880 ..	5·83	3·08	2·75	7.45	——
Finest Assam (Black), cost total 4/2, June 4th, 1880	5·30	3·92	1·38	18·85	——
Very Fine Gunpowder (Green), cost total 3/11, June 4th, 1880 .	7·10	3·88	3·22	20·05	——
Common Gunpowder (Green), cost total 1/8, June 4th, 1880	6·16	4·00	2·16	18·50	——
Caper Tea (Black), cost total 2/0 June 4th, 1880	5·58	3·92	1·66	26·90	——
S. O. Pekoe (Black), cost total 2/4 June 4th, 1880	5·78	3·53	2·25	16·60	——
Averages	6·17	3·67	2·50	14·79	34·27

SWEDISH LAWS AFFECTING SALE OF POISONS.

By C. Heisch, F.C.S., F.I.C.

Read before the Society of Public Analysts, on May 18th, 1881.

CONCLUDED.

Proclamation by Royal Board of Health of Stockholm, 28th February, 1876.

After a long preamble it gives a catalogue.

First.—Of poisonous matters which may only be sold by druggists, or chemical manufacturers who have prepared them, and only in conformity with rules laid down in Decree of January 6th.—Amygdalin, Chloride of Antimony, Metallic Arsenic, Arsenic Acid, Arseniate of Soda, and all Arsenical Salts other than painters' colours; Arsenite of Potash and other Arsenites not being painters' colours; Atropin and its Salts; Oil of Bitter Almonds, containing Prussic Acid; Cyanide of Potassium, and Cyan. Salt, which is mixture of KCy and NaCy; Prussic Acid; all Cyanides, except those containing Iron, such as Red and Yellow Prussiate of Potash, Prussian Blue, &c.; Digitalin, Phosphorus, Chloral Hydrate, Chloroform, Koniin and Salts; Tartar Emetic, Antimonial Wine, Antimoniate of Potash, and Emetic Salts in general; all Bases extracted from Opium and Salts appertaining thereto; Nicotine and Salts; Picrotoxin; all Mercurial Salts, Oxide, Chloride, and Sublimate; Strychnia; Brucia and Salts; Sulphides of Arsenic, Orpiment, Realgar, &c.; Oil of Sabine and other preparations; Veratrin and Salts; Vegetable Alkaloids, other than above; Aconite, Colchicin, Sabadillin, &c., with their Salts or corresponding Extracts; Belladonna Leaf, Root, or Extract: Bitter Almond Water, Extract Henbane, Prussic Acid Emulsion, Curare and Urare Poisons; Digitalis Leaf, Extract, and Tincture: Elaterium; Ignatius

Bean; Indian Hemp or Extract; Kalabar Bean; Cocculus Indicus; Croton Seeds or Oil; Mezereon; Lactucarium; Laurel Water; Lobelia Herb and Tincture; Secale and preparations; Conium and preparations; all preparations of Opium, Euphorbium, Veratrin, Hellebore, Nux Vomica, Sabadilla; Scammony; Cantharides and Extract, &c.; Stramonium; Staphisagria; Aconite Root, Leaf, or Extract; Colchicum and preparations.

Second.—Such poisons as may be sold by licensed dealers according to rules in Decree of January 6th.—Ammonia, Aniline, Baryta Salts, Litharge, Red Lead, Sugar of Lead, Strong Oil of Vitriol, Sulphates of Copper and Iron, Oxalic Acid, Salts of Sorrel, Ink Powder, Caustic Potash and Solution, Chloride of Zinc, and Chloride of Zinc and Ammonia, Bisulphide Carbon, Blue Vitriol, Blue Stone, Oxide Copper, Chromic Acid Oxide and Salts, Caustic Soda and Solution, Nitro-benzol, Mirbane Oil, Imitation Oil of Bitter Almonds, Oxalic Acid, Nitric Acid, Muriatic Acid, Nitrate and Oxide of Silver, Salts of Tin and Zinc, Concentrated Acetic Acid. Poisonous colours, containing Zinc, Cadmium, Bismuth, Tin, Chromic Acid, Antimony, Lead, Copper, Mercury, and Arsenic. Those most usually used are mentioned, but all cannot be specified.

WHITE COLOURS.

White Lead, Hamburg White, Dutch White, Pearl White, Silver White, Slate White, Spanish White, Tin White, Venetian White, Bismuth White, Zinc White.

GREY AND BLACK COLOURS.

Lead Black, Iron Black, Copper Black, Black Cinnabar, Zinc Grey, all Coal Tar Grey and Black Colours when they contain arsenic, copper or other poisonous material.

RED AND ORANGE COLOURS.

Red Sulphide of Antimony, Red Lead, Realgar, Cinnabar, Vermilion, Orange Chrome, Red Chrome, Minium, Paris Red, Red Varnish Paints, Amarin, Berlin, Viennese and Fenambruck Reds, Sap Red, &c. Red and Yellow Tar Colours when they contain arsenic or other poisonous ingredients.

YELLOW COLOURS.

Antimony Yellow, Baryta Yellow, Cadmium Yellow, Lemon Chrome, Yellow Ultramarine, Gamboge, Hamburg Yellow, Jaune Brilliant, Kassel Yellow, Imperial Yellow, Cologne Yellow, Chrome Yellow, Leipsic Yellow, Massicot, Mengel Yellow, Mineral Yellow, Neapolitan Yellow, New Yellow, Patent Yellow, Permanent Yellow, Picric Acid, Siderin Yellow, Steinbuhl Yellow, Verona Yellow, Zinc Yellow and Zinc Chrome, Brass Lacquer made with metallic salts. All Yellow Tar Colours which contain arsenic or any poisonous ingredients, Orpiment, and all Sulphides of Arsenic.

BLUE AND VIOLET COLOURS.

Azure Blue, Celestial Blue, Bremen Blue, Cerulian Blue, Sky Blue, Chalk Blue, Cobalt Ultramarine, Cobalt Violet, Copper Blue (blue verditer), King's Blue, Mineral Blue, Neuberg Blue, Smalt, Thenand's Blue, Violet, Lac and Zinc Blue. All Blue Tar Colours containing arsenic or other poisonous substances.

GREEN COLOURS.

Azure Green, Brunswick, Bremen, Cassilman's, Elsners and Cinnabar Greens, English, Ground, Cassel's, Imperial and Cherryhill Greens, Cobalt Greens, Chrome, May, Mineral Moss, Neuwied's, New, Original, Parrot, Paris and Permanent Greens (Pickel and Reseda), Rinmon's, Scheele's, Schweinfurt, Swiss, Emerald, Spanish, Turkish, Vienna, Victoria, Wurzburg, Zinc and Verdigris, Green and all Green Tar Colours containing arsenic or other poisonous ingredients.

BROWN COLOURS.

Hatchett's, Chemical and Copper Browns, Copper Red Brown, Bismuth Brown, and all Brown Tar Colours, containing arsenic or other poisonous ingredients.

It is remarkable that all Coal Tar Colours contain arsenic or other poisonous matters, but no hint is given that any are in themselves deleterious.

This very important sentence follows the list of colours:—

Regarding the existence of arsenic in colours or paints, it has hitherto been supposed that this substance is found only in copper green colours. It is now known to exist in many other colours, amongst which are some of the brightest reds which are supposed to be heightened in brilliancy by arsenic. This poison is also found in many grey colours employed in the manufacture of paperhangings; also in Aniline colours which have been carelessly purified. In these arsenic would not be suspected, and can only be found by chemical process.

List of articles which may be used to colour confectionery:—

WHITE COLOURS.

Chalk, Starch (Potato or Arrowroot).

BLACK COLOURS.

Ivory Black, Lamp Black, Charcoal Soot, Indian Ink.

RED COLOURS.

(In Decree all Mercurial Salts are prohibited).

Carmine, Vermilion, Cochineal, Red Sandal, Brazil Wood, Currant Juice, Alkanet, Raspberry, Barberry, Saffron.

YELLOW COLOURS.

Saffron, Turmeric, Annatto, Quercitron, Quassia, Marigold, Persian Berries.

BLUE AND VIOLET COLOURS.

Clean Ultramarine, Indigo, Archil, Purple Iris, Logwood, Wormwood Flowers, Bilberry, Elderberry, Sloes, Black Cherry, Mulberry, Black Currant.

GREEN COLOURS.

Spinach, Pistacio, or any of the above named yellows and blues mixed.

BROWN COLOURS.

Burnt Sugar, Coffee, Catechu, Chino, Liquorice.

METALS.

Gold and Silver Leaf, pure.

The absolute prohibition of the sale of all paperhangings, &c., containing arsenic having been found oppresive to tradesmen, in November, 1879, the following definition of what was to be considered arsenical within the meaning of the Decree was published:

No paperhangings to be sold if a piece of 50 Swedish square inches (68·2 English square inches) or less can by chemical means have produced from it metallic arsenic sufficient to produce a black or brown mirror in a glass tube 2 millimetres (·04 inch English) internal diameter.

Textile fabrics, lamp shades, &c., if 25 Swedish square inches show similar mirror.

Candles, Sealing Wax, &c., if a sample weighing 5 Swedish orts (385·8 grs. English) can be made to show similar mirror.

Chemists employed, to give certificates under hand and seal, accompanied by an hermetically sealed tube containing the mirror obtained as above, and also a piece of the paper, &c., large enough to identify it with the original goods, and to enable a further analysis to be made, in case of dispute, and shall be accompanied also by a certificate from the analyst that all his chemicals were duly tried by him and found free from arsenic.

To come into force on 1st July, 1880.

It is to be regretted that no more definite directions as to the productions of this mirror are given, or how much arsenic per piece of paper it is supposed to represent, as differences would be pretty sure to arise amongst analysts as to the meaning of a black or brown mirror, &c.

ON MAUMENÉ'S TEST FOR OILS.

By Alfred H. Allen.

Read before the Society of Public Analysts on 11th May, 1881.

Some years ago M. Maumené published a method of testing oils which was dependent on the rise of temperature observed on mixing a known weight of the sample with a definite amount of strong sulphuric acid. The value of the principle has been confirmed by observers, who have also proved the approximate constancy of the results obtained.

Maumené's experiments were made by mixing 50 grammes of the oil with 10 c.c. (= 18·45 grammes) of concentrated sulphuric acid in a beaker, or large test tube,* stirring the mixture with a thermometer, and noting the greatest rise of temperature produced.

Fehling, and, under his direction Faisst and Knauss, operated in an exactly similar manner, but they employed 15 grammes of oil to 5 grammes of acid. In the latter mode of manipulating, the temperature obtained is somewhat less elevated, owing to the greater proportional loss by conduction and radiation. The acid should be gradually added from a burette or pipette, while the mixture is continuously stirred with the thermometer.

The following figures show in a tabular form the rise in temperature observed by Maumené and Fehling respectively, when working the manner already described† :—

Kind of Oil.	Rise of Temperature Observed.	
	Maumené. °C.	Fehling. °C.
Castor	47	
Olive	42	37·7
Sweet Almond	52·5 to 53·5	40·3
Bitter Almond	52	
Rape	57 to 58	55
Colza Rape	58	
Arachis (Earth-nut)	67	
Beech-nut	65	
Sesamé	68	
Poppy-seed	74·5	70·5
Hemp-seed	98	
Walnut	101	
Linseed	103	
Cod-liver	102 to 103	
Skate liver	102	
Horse-foot	51·5	
Tallow oil	41 to 43·5	

In the case of linseed oil, and other oils giving much heat, it is necessary to use a somewhat tall beaker, as the mixture swells greatly owing to the gas generated.

† My excuse for re-publishing in detail the results of other chemists is that many of the figures given in the test have not, to my knowledge, hitherto found their way into any English journal or book, and have not previously been correlated.

The original figures of Maumené have been recently verified and added to by him, and those of Fehling have been confirmed by other observers, especially in the case of olive oil. Thus: MM. Faisst and Knauss, employing Fehling's proportions, observed a rise of 38° C. in the case of pure olive oil, whilst with poppy-seed oil the rise was not less than 70° C. In mixtures of the two oils, the *additional* rise of temperature was regularly 1·6° C. for every 5 per cent. of the adulterant.

Nearly all fatty oils, except oil of ben, and tallow and lard oils, produce a higher rise of temperature than olive oil, so that an excessive increase is a valuable indication of admixture, and even of its approximate extent.

The results of Maumené and Fehling appeared so important that I thought it unfortunate that the list of oils examined by them was deficient in certain important respects. With a view of verifying their results, and of extending them in certain respects, I have made a series of experiments by the same method, using in each case 50 grammes of the sample and 10 c.c. of sulphuric acid of 1·845 specific gravity. The following table shows the results obtained:—

Kind of Oil.	Specific Gravity at 15·5° C.	Rise of Temperature. °C.
1. Olive Oil, believed to be genuine	·9144	42
2. Best Salad Oil	·9156	38, 39, 39
3. Rape Oil, Brown, German ..	·9176	51, 55.
4. „ German	·9172	50·5
5. „ Brown, East Indian	·9166	54·5
6. „ East Indian ..	·9157	56·0
7. Cotton Seed Oil	·9285	60·5
8. „ „	·9283	57, 59
9. Niger Seed Oil	·9267	81
10. Linseed Oil, East Indian ..	·9326	109
11. „ Baltic	·9317	109
12. „ Baltic	·9341	110, 111
13. Cod Liver Oil, pale	·9270	113
14. Sperm Oil, genuine	·8811	45
15. „ genuine, finest ..	·8775	46
16. „ believed to be genuine	·8826	45
17. Russian "Oleo-naphtha" ..	·9050	3
18. Mineral Lubricating Oil ..	·8921	3
19. Shale Lubricating Oil ..	·8894	4
20. Rosin Oil	·9739	19

The oils from 3 to 12, inclusive, were obtained direct from the seed-crushers, and were certainly genuine. I have every confidence that the fish oils also were perfectly genuine and representative samples.

On the whole, the above results confirm the value of Maumené's method, and in some cases his observations also, but in other respects there are rather marked discrepancies.

It will be observed that the rise of temperature I obtained in the case of olive oil is exactly identical with the observation of Maumené. The salad oil, No. 2, which was of questionable origin, gave somewhat lower results in each of three determinations. Hence, it is difficult to suppose that the sample was otherwise than genuine.

In the case of rape oil, it will be noticed that the two samples of German rape gave sensibly less heat than the East Indian samples, while these last scarcely rose to the temperature observed by Maumené.

On the other hand, the results obtained by me from three samples of linseed oil are all higher than that of Maumené, and the same remark applies to the rise of temperature obtained with cod-liver oil.

It will be observed that the hydrocarbon oils produce much less heat on treatment with sulphuric acid, and that rosin oil is itself sharply distinguished from the shale and petroleum products.

Maumené, in a very recent paper, states that: "Recently heated acid, without having lost the least trace of water, presents very different actions, at least so far as the disengagement of heat which accompanies them, from those produced by the same acid long prepared. The contradiction of this great fact by M. Berthelot does not appear to me to be well founded."

I am not quite clear what strength of acid Maumené employed, as I am unable to comprehend the term "l'acide ordinaire à 83·5° densimetriques.' It may mean either acid of 1·835 specific gravity, or acid containing 83·5 per cent. of SO_3. Maumené compares the temperatures produced by using this acid, with those obtained with the same acid recently heated to 320°, cooled, and employed at the ordinary temperature. With 5 c.c. of these acids, and 25 grammes of various samples of linseed oil (half the original quantities), Maumené obtained such results as 66° and 148°; 55° and 138°; 59° and 146°.

With a view of confirming these interesting results, I have ascertained the heat evolved by mixing 50 grammes of certain of the oils in the foregoing list with 10 c.c. of the same acid previously used, but which had been heated to boiling and partially evaporated in platinum, then cooled to the ordinary temperature, and used without delay. The following are the results:—

No.	Kind of Oil.	Increase of Temperature, °C.	
		With old acid.	With recently boiled acid.
2	Best Salad Oil	38, 39, 39	39·5
3	Rape Oil	51. 55	52
4	Rape Oil	50·5	51
10	Linseed Oil	109	108
11	Linseed Oil	109	110
12	Linseed Oil	110, 111	111

These results offer a direct contradiction to those of M. Maumene. They might be extended, but in the face of the almost absolute agreement between the temperatures produced by the two acids, there is not much encouragement to pursue the matter farther. I can suggest no explanation of M. Maumene's results, unless it be that his acid really increased in strength by the heating, in opposition to his express statement to the contrary. A comparatively slight variation in the strength of the acid used certainly causes a notable difference in the rise of temperature.[†] I suspect on several grounds that the concentrated sulphuric acid used in France is not always of full strength.

Maumené concludes his paper by stating that he maintains, in contradiction to M. Berthelot, that recently heated sulphuric acid gives different temperatures when mixed with water from that produced by old acid. On mixing 10 c.c of each of the acids used for the oil experiments with 20 c.c. of water, I found the rise of temperature to be respectively 81° and 82° C.

I am indebted to Mr. Charles Harrison for the very careful manner in which, under my direction, he has made most of the experiments the results of which are recorded in this paper.

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[*] "Sur l'action de l'acide sulphurique recemment chauffee à 320° et les huiles."—*Comptes Rendus*, March 21st, 1881, page 721.

[†] It would perhaps be a wise precaution always to employ recently boiled acid, so as to ensure its being of full strength.

SOURCES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

Darlington, Stockton and Middlesbrough.—The water supplied to the three towns is identical in composition. It is obtained from the river Tees, which rises in Crossfell, in Cumberland. The gathering grounds are mainly peaty moorlands. The bed of the river is chiefly composed of carboniferous limestone. Down to the pumping station the river is shallow and has a rapid flow over rock and shingle. In its course it receives two important tributary streams—the Lune and the Balder. It also receives the sewage of Middleton-in-Teesdale, Barnard Castle and Gainford, which have an aggregate population of about 8,000. The pumping stations are at Broken Scar, 2½ miles west of Darlington. The water is lifted into settling ponds, thence to filter beds of ordinary construction. Speaking of Darlington itself the filters somewhat lack efficiency, for in flood time the water is seldom free from turbidity. There are practically no storage reservoirs. There are small reservoirs attached to each works, which hold about enough for one day's consumption, so that the supply is really continuous. The works are in the hands of the Corporation of Darlington, and a Joint Water Board for Stockton and Middlesbrough.

Ipswich has two water supplies, a high and a low service. The high service supply is obtained from an artesian well in Waterworks Street, having a bore 15 inches in diameter, and a depth of 112 feet into the chalk. 400,000 gallons are pumped daily into mains which supply the higher parts of the town. The low service supply is surface water obtained from gathering grounds at Holy Wells, Burk's Hill, and Christchurch Park, and stored in reservoirs. This water supplies the lower parts of the town. In cases of fire the high service can be turned on to the low service pipes.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.

THE WATER SUPPLY OF PHILADELPHIA, U.S.A.

To the Editor of "The Analyst."

Sir,—I send herewith the report of the analysis of a sample of water taken during last week in April.

SCHUYLKILL WATER.

Colour in 2ft. tube	Very slightly yellow.
Smell at 100°F.	None.
Chlorine	0·53
Phosphoric Acid	None.
Nitrogen as Nitrates and Nitrites	0·0412
Oxygen absorbed in two minutes at 80° F.	None.
" " " four hours	0·0701
Hardness before boiling	4·5°
" after "	4·5°
Free Ammonia	None.
Albuminoid Ammonia	0·0091
Total Solids	7·01
Sediment	Vegetable debris with siliceous matter.

HENRY LEFFMAN, M.D.

920, *Walnut Street, Philadelphia, May 5th,* 1881.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in May, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	May 17	c. p. blue	none	1·92	traces	·740	none	·0022	·0060	·0120	22·2°	8·8°	31·00	satisfactory	Wigner & Harland.
New River	,, 18	clear v. f. yellow	none	1·01	none	·161	0014	·0035	·0042	·0560	13 6°	8·2°	17·92	satisfactory	B. Dyer.
East London	,, 16	c. green yellow	none	1·34	traces	·245	·0002	·0023	none	·0310	12·6°	5·1°	20 00	veg. deb. fib. mycel. anim.	Wigner & Harland.
Southwark & Vauxhall	,, 9	v. p. green. yelw.	none	·96	trace	·120	·0012	·0051	·0010	·0537	14 0	3 0°	19·61	mnl. diams. few infusoria	J. Muter.
West Middlesex	,, 10	yellowish	none	1·04	trace	·180	·0007	·0020	none	0100	13·5°	3·5°	18·37	satisfactory	O. Hehner.
Grand Junction		p. yellow	none	1·06	trace	·121	·0006	·0039	0061	·0380	13·3°	3·8°	19·10	no deposit	A. Wynter-Blyth.
Lambeth	,, 11	v. p. green. yelw.	none	·99	trace	·140	·0014	·0040	·0022	·0530	14·0°	3 0°	19 80	s. mineral and diatoms	J. Muter.
Chelsea	,, 7	c. p. green. brn.	none	·89	trace	·080	·0010	·0035	·0030	·0390	13·0°	3·0	17 64	good	A. Dupré.
Bath	May 12	c. f. blue	none	1·01	none	·077	none	·0007	none	none	16·0°	4·5°	19·20	no deposit	J. W. Gatehouse.
Birmingham	,, 3	turbid greenish	none	1·47	traces	·231	·0020		·0070	·0350	8·7°	4·5°	16·95	vegetable matter	A. Hill.
Bradford	,, 16	s. yellow opaque	none	·75	none	none	·0007	·0063	·0300	·1700	4·0°	3·7°	7·20	no deposit	F. M. Rimmington.
Brighton	,, 9	c. p. green ylw.	slight	2 00	traces	·508	0011	·0013	none	none	14·0°	3·0°	23·40	vegetable debris	Wigner & Harland.
Bristol	,, 3	brownish green	none	·90	none	·070	none	·0019	·0021	·0280	14 0°	1·7°	20·80	sand	F. W Stoddart.
Cambridge	,, 9	c. pale blue	none	1·40	h. trace	·560	·0021	·0021	·0039	·0148	18·8	6·4°	25·90	satisfactory	J. West-Knights.
Canterbury	,, 14	pale blue	none	1·47	none	·338	·0005	·0006	·0050	·0130	8·5°	4·0°	14·28	v s. mineral	S. Harvey.
Croydon	,, 18	bright colourless	none	1·12	trace	·340	none	·0010	none	·0080	15·5°	9·0°	25·60	no deposit	C. Heisch.
Coventry	,, 18	f. yellow	none	1·50	traces	·163	none	·0105	·0010	·0130	17·4°	6·1°	30·60	sand	H. Swete.
Darlington	April 26	yellow s. turbid	none	·70	trace	·017	trace	·0028	·0070	·1220	5·6°	5·2°	10·36	satisfactory	W. F. K. Stock.
Derby	May 16	v. good	none	·90	trace	·075	·0007	·0010	none	·0027	11·1°	4·4°	16·59	satisfactory	L. Archbutt.
Droitwich	,, 17	blue	none	2·40	none	·141	none	·0007	·0014	·0307	33·2°	19·4°	35 18	satisfactory	H. Swete.
Dublin	April 26	s. yellow	none	·79	traces	traces	·0020	·0075	none	·0500	1·5°	1·0°	4·60	satisfactory	C. A. Cameron.
Dudley	May 14	f. green	none	1·30	none	·341	none	·0028	·0110	·1831	17·0°	10 0°	24·08	vegetable debris	H. Swete.
Edinburgh	,, 16	f. brown	none	·78	none	v. f. trc.	·0008	·0048	·0096	·0284	8·7°	8·2°	5·52	none	J. Falconer King.
Exeter	,, 8	f. greenish yelw.	none	·91	trace	·114	·0007	·0036	none	·0379	2·9°	2·9°	6·30	none	F. P. Perkins.
Greenock	April 23	light brown	none	1·02	none	·002	·0056	·0077	·0500	·2500	1·9°	1·5°	4.90		J. W. Biggart.
Grantham	May 8	c. pale blue	none	·84	trace	·490	·0006	·0011	none	·0185	15·3°	4·4°	22 17	diams. min. mvg. orgs	A. Ashby.
Huddersfield	,, 14	c. s. brwn. yelw.	none	·60	trace	·010	none	·0012	·0010	·0300	2·0°	2·0°	5·20	peaty matter	G. Jarmain.
Hull	,,	good	none	1·20	trace	·237	·0013	·0027	·0025	·0030	15·0°	8·5°	20·26	satisfactory	J. Baynes, Jun.
Ipswich	,, 14	c. colourless	none	2 12	trace	·190	·0030	·0042	none	·0087	19·2°	8·4°	29·92	satisfactory	J. Napier.
King's Lynn	,, 9	milky white	veg. mttr.	1·74	h. traces	·204	·0028	·0119	·0252	·2800	14·6°	4·4°	21·00	diatoms bacteria	W. Johnstone.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in May, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leeds	May 17	yellowish brown	none	·74	trace	none	·0003	·0031	·0140	·1344	8·6°	3·0°	5·04	peaty matter	T. Fairley.
Leicester	,, 18	v. s. yellow	none	1·25	trace	·110	·0020	·0033	·0030	·0750	7·30°	4·4°	14·66	satisfactory	W. L. Emmerson.
Liverpool	,, 17	greenish yellow	peaty	1·08	traces	·077	·0028	·0042	·0056	0912	4·6°	4·4°	8·40	satisfactory	A. Smetham.
Llandrindod ..	,, 17	blue	none	1·20	none	·086	none	none	·0005	·0120	10·2°	6·2°	10·90	satisfactory	H. Swete.
Maidstone—															
Wtr. Company	,, 18	clear	none	2·30	trace	·707	none	none	·0028	·0305	17·5°	7·9°	34·75	none	M. A. Adams.
Public Conduit	,, 18	clear	none	2·50	trace	·611	none	·0007	·0028	·0274	17·5°	8·3°	33·88	none	M. A. Adams.
Manchester....	,, 13	c. s. yellowish	none	·86	none	none	·0029	·0012	·0108	·0602	1·7°	1·6°	5·257	mineral sediment	W. Thomson.
Newark	,, 7	bl. grn. s. turbid	none	1·26	trace	·050	·0009	·0013	none	·0155	16·1°	8·5°	32·42	few diams. & mvg. orgms.	A. Ashby.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·88	trace	·013	·0010	·0080	·0050	·0380	15·1°	5·5°	18·10	satisfactory	J. Pattinson.
Nottingham ..	,, 19	p. c. blue	none	1·78	traces	1·295	·0006	·0058	none	·0074	18·0°	10·2°	24·80	fibrs. veg. deb. diams. hair	Wigner & Harland.
Northampton..	,, 14	v. p. yellow	none	5·50	traces	·611	none	·0014	·0007	·0460	13·2°	6·5°	55·24	satisfactory	H. Swete.
Norwich	,, 12	s. greenish yelw.	none	1·90	traces	·547	traces	·0014	·0280	·0691	8·5°	2·5°	9·20	satisfactory	W. G. Crook.
Oldham	,, 10	s. turbid yellow	none	·85	traces	·019	·0078	·0025	·0008	·0060	4·0°	3·6°	5·06	satisfactory	C. Estcourt.
Portsmouth ..	,, 10	clear	none	1·03	trace	·200	trace	·0021	none	none	14·7°	3·7°	20·10	vegetable deb. decayed	W. J. Sykes.
Reading	,, 11	c. bluish	none	·88	none	·110	·0005	·0045	·0030	·0350	11·1°	4·3°	18·35	satisfactory	J. Shea.
Rochdale	,, 15	pale blue	none	·50	none	·006	·0020	.0030	·0016	·0300	8·6°	1·5°	1·90	satisfactory	T. A. Collinge.
Rugby	,, 7	v. turbid	none	·81	h. traces	·287	·0105	·0070	·0123	·0313	11·0°	5·5°	17·50	veg. deb. diatms. bacteria	A. P. Smith.
Salford	,, 9	c. yellow	none	·60	none	none	·0028	·0085	·0140	·0190	2·5°	2·0°	5·00	none	J. Carter Bell.
Sheffield	,, 17	brown turbid	none	·10	none	none	·0028	·0056	none	·0630	4·8°	1·8°	1·97	satisfactory	A. H. Allen.
Shrewsbury ..	,, 6	c. colourless	none	1·50	traces	·300	none	·0015	none	none	22·8°	3·7°	25·00	no deposit	T. P. Blunt.
Southampton..	,, 16	greenish yellow	sligt. weedy	·99	h. traces	·181	·0016	·0049	·0070	·0770	12·5°	1·5°	19·90	vegetable debris	A. Angell.
Stockport	,, 12	v. s. turbid	none	1·02	h. traces	·031	·0022	·0028	·0012	·0060	4·8°	3·8°	6·41	satisfactory	C. Estcourt.
Stourbridge ..	,, 14	blue	none	8·00	none	·910	·0007	·0042	·0046	·0932	21·0°	7·2°	36·10	satisfactory	H. Swete.
Stourport	,, 14	f. blue	none	1·50	none	·191	none	·0035	·0048	·0692	14·0°	6·8°	21·11	sand	H. Swete.
Sunderland....	,, 16	c. colourless	none	2·00	trace	·280	·0023	·0030	·0020	none	9·6°	3·7°	25·00	vegetable debris	H. J. Yeld.
Swansea	,, 16	s. turbid	none	1·00	trace	none	·0007	·0056	·0030	·0040	3·0°	2·5°	4·27	earthy matter	W. Morgan.
Warwick	,, 9	greenish	none	1·19	none	.700	·0037	·0035	·0140	·0110	19·2°	11·0°	23·80	none	A. B. Hill.
Whitehaven ..	,, 5	c. f. green	none	·38	none	·012	none	·0007	none	·0125	·1°	·1°	2·19	vegetable deb. diatoms	A. Kitchin.
Wolverhampton	,, 14	yellowish tinge	none	1·33	h. traces	·124	none	0063	·0013	·0680	12·6°	5·2°	19·88	desmids and diatoms	E. W. T. Jones.
Worcester	,, 12	v. p. yellow	none	3·10	traces	·075	none	·0049	·0081	·1532	11·3°	7·7°	18·20	vegetable debris	H. Swete.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the March Table the Nitrates in the CHELSEA water should have been ·1400 instead of ·5300.
In the April Table the Oxygen of the BIRMINGHAM water absorbed in 4 hours should have been ·035 instead of ·305.
In the April Table the Hardness before boiling in the CAMBRIDGE water should have been 19·0° instead of ·2°.

SALE OF FOOD ACT IN SCOTLAND.

To the Editor of "The Analyst."

Sir,—I fear the working of the "Act" will not be of much advantage, in some places, at least, until a clause is introduced making it compulsory on all Burghs, &c., who appoint an Analyst, to take a certain number of samples every year, the number to be in proportion to the population. A short time ago I addressed a letter to the Town Clerks of several towns for which I am Analyst, directing attention to the fact that nothing whatever had been done in the way of carrying out the Act. These letters have been read at the Meetings of Councils, and the discussions which ensued seem to me to point to the conclusion that the worthy councillors, from the provosts downwards, have the most hazy ideas of the meaning or intentions of the "Food, Drink and Drugs Act," which they some years ago adopted—I presume *unanimously*. The newspaper reports of two of these meetings which I herewith send you, will prove entertaining. "The provost suggested that it was more for private individuals than the Town Council to send samples, and thought the clerk should write to me to the effect that the public were quite satisfied with the article supplied to them." Happy public! but of course "Where ignorance is bliss," &c. There is a certain grim humour in the worthy provost's remarks when taken in connection with the fact that a number of milks sent to me by a neighbouring burgh, were found in the majority of cases to be pretty freely watered. A member of the council "thought the inspector might be allowed to act without instructions," but a no doubt intelligent bailie said "the only time the officer could act was *when he got a case*." Perhaps the most amusing oration, however, was given by another councillor, who "thought the Analyst should employ some one here to take samples for him. They had been paying for this gentlemen for a considerable time, and *had never got a single article from him*. It was a consideration whether things should continue in this way or not." Verily here is indeed a second Daniel come to judgment. Seriously speaking, however, is it not a pity that any burgh authority should display so little understanding of the meaning of the "Act" or the duties of the Analyst? It seems to be but another instance of the popular idea that the Public Analyst is a species of roaring lion going about seeking whom he may devour, instead of a comparatively inoffensive individual who only does what he is asked, and is by no means too well remunerated for doing that.

I am, &c.,
A COUNTY ANALYST.

WATER ANALYSIS.

To the Editor of "The Analyst."

Sir,—As Medical Officer for a large combined urban and rural sanitary district, I have had to analyse a great number of waters during the past eight years. Hence I have had ample opportunity of becoming thoroughly acquainted with the character of the waters from the various localities in my district. Knowing thus their normal constitution and the local circumstances attending each case, I have unusual facilities for judging of the purity or otherwise of the samples submitted to me, and have therefore the advantage over any chemist who may have to form an opinion from arbitrary standards alone. I recently had occasion to analyse a certain well water from Newark-on-Trent several times, the results of my last analysis being given in the subjoined table—No. I. The analysis affording what I considered ample and conclusive evidence of sewage pollution, I reported to the sanitary authority that the water was unfit for drinking, and advised that the well should be closed.

On the refusal of the owners to comply with their request, the authority applied to the magistrates for an order to close it, under sec. 70, Public Health Act, 1875.

At an adjourned hearing of the case, a written report on the water by Dr. Charles Graham, of University College, was handed in by the defendants (see table No. II), in which he stated that the water was pure for dietetic purposes. On account of this conflict of opinion, the magistrates dismissed the summons.

Being convinced that my analysis and the conclusions I had drawn from it were correct, I forwarded a sample to Mr. Hehner, without giving him any information of the attending circumstances, and he reported that it was highly polluted, and unfit for drinking.

The sanitary authority thereupon applied again for a summons. Meanwhile, before the hearing of the fresh case, I personally delivered samples of the water to Dr. Dupré, and to Mr. Hehner, and again analysed a sample myself. They both condemned it as being polluted with sewage, and unfit for drinking (see tables Nos. III. and IV.).

When the case came on, Dr. Dupré was detained in London, but Mr. Hehner and I gave evidence, Dr. Graham's report being again handed in.

The magistrates were still not satisfied, so ordered a sample to be sent to an "independent analyst," selected by themselves.

Then appeared in a local paper, a letter to the defendants from Dr. Graham, in which he says "From the small amount of free and albuminoid ammonia, the small quantity of nitric acid, the absence of charring or blackening or ignition of the solids, the slight quantity of oxygen needed to burn the organic matter, even when kept at 100° F. for three hours, I am of opinion that the water is free from sewage infiltration. . . . . . . I am still of opinion that there are no grounds, from chemical data, to warrant anyone in condemning the water. . . . . . . Chemical examination does not justify the statement that the water has been polluted by sewage. It is indeed very free from organic impurities."

The magistrates sent the water to Dr. Frankland, and he subsequently reported that it consisted chiefly of the soakage from drains or cesspools, and was a very dangerous water, and quite unfit for dietetic use, also strongly urging the immediate closing of the well.

The magistrates then ordered that the well should be closed within a month.

Disagreements may be expected. no matter what method of analysis be employed, in the case of waters neither decidedly pure nor plainly bad; but in extreme cases of impurity, differences of opinion do not appear to be justifiable in the present state of chemical knowledge. Nothing lowers the profession of chemists in the eyes of the unscientific public so much as unaccountable and unseemly differences, when brought to light in a court of law.

Seeing that the concensus of opinion expressed by the other chemists consulted is so marked, may I venture to ask the learned Professor to reconsider the decision he has given with reference to the water in question.

I append the analytical data, and extracts from the reports alluded to above.

The results are expressed in parts per 100,000—grains per gallon, as given in two of the reports having been calculated up to this quantity.

	Chlorine.	SO_3.	Nitric Acid. N_2O_5.	Organic Carbon.	Organic Nitrogen.	Free Ammonia.	Albuminoid Ammonia.	Oxygen absorbed from Permanganate.	Phosphoric Acid.	Total Solids.
I. Ashby	7·60	—	15·72	—	—	·0005	·0196	·234	heavy traces	106·0
II. Graham	7·83	—	slight trace	—	—	·0020	·0154	·170	—	108·0
III. Hehner	7·48	17·8	16·15	—	—	·0004	·0195	·227	strong trace	108·4
IV. Dupre	7·80	—	16·90	—	—	·1020	·0360	·151	very much	104·8
V. Frankland	8·20	—	14·55	·951	·218	·0	—	—	—	108·0

The following are extracts from the reports:—

I. Ashby. The water is polluted with nitrogenous and carbonaceous organic matters. The large quantities of Cl., N_2O_5 and P_2O_5 found in it indicate that the impurities are of sewage origin. It is very impure and dangerous to health, and is quite unfit for dietetic purposes.

II. Graham. The amount of organic matter as indicated by the O used is low. The saline and albuminoid ammonia are equally satisfactory. The water is pure for dietetic purposes. It contains too much solid matter to be a high class water, but in other respects is satisfactory.

III. Hehner. It is very highly polluted with sewage. It is not only absolutely unfit for drinking and other domestic purposes, but its use would be fraught with considerable danger to the consumers. I would urgently advise the closing of the well.

IV. Dupre. It is very largely polluted by sewage or surface drainage, as shown by the very high proportion of N_2O_5, Cl., and P_2O_5 found, the excessive amount of albuminoid ammonia yielded, the rather large amount of O absorbed, and other points. The water is utterly unfit for drinking.

V. Frankland. It consists chiefly of soakage from drains or cesspools, and contains a very large proportion of organic matter of animal origin. It is a very dangerous water, and quite unfit for dietetic use. The well from which it was drawn should be closed without delay.

The question being one of extreme importance to all professional chemists and medical officers of health, must be my apology for the length of this communication, to which, together with any discussion that may arise from it, I hope you will, on the same count, kindly consent to give a place in your valuable paper.

I am, yours obediently,

Grantham, *May 20th, 1881.* ALFRED ASHBY.

LAW REPORTS.

Whisky Adulteration :—

Mr. Thomas George Mumford, proprietor of the "Union" Tavern, Mint Street, Borough, was summoned before Mr. Slade by Mr. Edwards, the officer appointed by the Vestry of Saint George, Southwark, for selling to the prejudice of the purchaser an article of food, viz., whisky, which was not of the nature, substance, and quality demanded by such purchaser, it being reduced spirits more than 25 degrees under proof. Mr. Slade observed that publicans were allowed to reduce spirits to the extent of 25 degrees, but 37 seemed rather too much. He asked Mr. Edwards if it was adulterated with anything worse than water. Mr. Edwards replied in the negative. The certificate stated "Not injurious to health." The defendant said, in answer to the charge, that he had only recently taken the business, and he was not aware that the whisky had been reduced to that extent. He was only in a small way of business. Mr. Slade fined him 10s., and 12s. 6d. costs.

Refusing to Serve, and Assault.—

At Hammersmith, on Saturday, Allen Mannering, of Crofton Terrace, Hammersmith, appeared to answer two summonses, one for refusing to sell a pound of butter to Henry Oatley, an inspector appointed under the Sale of Food Act, and the other for assaulting him in the execution of his duty. Mr. Jones, clerk to the Fulham District Board of Works, handed to the magistrate a certificate of the analyst, stating that the butter contained 60 per cent. of foreign fat other than butter. After hearing the evidence, which showed that the defendant was not the owner of the shop, Mr. Paget dismissed the summons for refusing to sell the butter, as he thought the purchase was complete. He, however, fined the defendant £5 for the assault.

Mr. J. H. Cornall, M.R.C.S., has been appointed Public Analyst for the Borough of Warrington.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
3641	L. A. Groth	Decomposition of Salts of Ammonia	6d.
3644	J. C. Bloomfield	Manufacture of Cement	2d.
3731	B. Biggs	Separation of Acetic Acid from Crude Pyroligneous Acid and Spirit	2d.
3745	P. M. Justice	Purifying and Whitening Oils and Fats	4d.
3765	E. G. Brewer	Electric Lamps	1/2
3861	N. G. Richardson	Manufacture of Paper	2d.
3867	B. Hofmann	Manufacture of Oleine and Butterine	4d.
3939	E. H. T. Liveing	Colouring Alcohol for Thermometers	2d.
3971	A. M. Clark	Dynamo-Electric Machines	10d.
4017 & 4156	Ditto	Saving Hydrogen Gas Generated in Cleaning Wire ..	6d.
4056	W. Thompson	Manufacture of White Lead	8d.
4069	J. W. M. Miller	Preserving Animal and Vegetable Substances ..	2d.
4094	W. Elmore	Extracting Copper and other Metals from their Ores	4d.
4192	G. P. Harding	Electric Lamps for Engines	4d.
4303	T. Morgan	Converting Nitrogenous Organic Substances	4d.
5337	E. D. Brunel	Fire Extincteurs	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; Smithsonian Report, 1879.

THE ANALYST.

JULY, 1881.

SOCIETY OF PUBLIC ANALYSTS.

An Ordinary Meeting of this Society was held on the 1st June, at Burlington House, the President, Mr. Heisch, in the chair.

The minutes of the previous meeting were read and confirmed.

Mr. Bernard Dyer and Mr. Hobbs were appointed scrutineers, and having opened the voting papers, they reported that the following had been elected as members:—E. G. Love, Ph.D., Analytical Chemist, New York; H. Leffmann, M.D., Analytical Chemist, Philadelphia.

Mr. C. M. Blades was proposed as a member, and will be ballotted for at the Country Meeting.

Mr. Wigner read a paper on "The Valuation of the Relative Impurities in Potable Water," and a long discussion ensued.

A Special Meeting of the Society was held at Burlington House on the 27th June. A Report of the Papers then read will appear in our next Number.

ON THE VALUATION OF THE RELATIVE IMPURITIES IN POTABLE WATERS.

By G. W. Wigner, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 1st June, 1880.

About three years ago I submitted to the Society a scheme for the systematic valuation of the *impurities* found in potable waters, based upon the plan of giving a value to every constituent found in a water. This scheme was discussed at the time, and some suggestions then made were adopted and have rendered it more generally applicable. During three years the scheme has been tried by many analysts, and it is in consequence possible to discuss it with greater advantage.

Some six months ago the Water Committee of the Society very carefully considered the scale, and after a slight alteration of two or three items, it was decided to give it a temporary trial on the analyses of public water supplies made by the members of the Society for publication in The Analyst, and to bring the subject forward for discussion at this meeting.

In considering the details, one result of the alterations from the original scale must be borne in mind. Certain values have been altered, and consequently the value of 35 which I proposed as the limit of a first-class water may be no longer tenable, and I shall therefore submit another proposal for that limit. It appears probable that we may find some further alterations are necessary in order to make it universally applicable to the various classes of waters from which public supplies are drawn.

I will at once assume that all analysts are agreed on the desirability of greater uniformity in the expression of opinion on the results of water analyses, as well as in the mode in which the analyses should be carried out.

In almost every case the purpose for which a water analysis is made is to obtain an opinion as to purity and suitability for domestic use, but at present it is a not uncommon occurrence that two analysts obtain results which are almost identical, and yet they differ considerably in the opinion they give on those results. It is with a view to obviate this undesirable state of things that we are to discuss the matter to-night.

There are certain points which will be very generally assented to, and may be used as starting points for the purpose of testing the proposed scale.

First. Every constituent found in the course of an ordinary water analysis must have a certain value or importance corresponding to the proportion in which it is found, no matter how small that proportion may be. It is quite true that when certain constituents, say, for instance, chlorine in chlorides or nitrogen in nitrates are present in very small proportions only, their importance may be so slight that they are ordinarily ignored in forming an opinion, but it is a more sound and logical course to consider their importance or value, small as it may be, as forming part of a total rather than to consider the determinations as valueless.

Second. If any constituent of a water, no matter what, is found in undue or excessive proportion, it ought to be sufficient to condemn that water for domestic use.

Third. There must be a certain minimum valuation approximating to that of the purest public supplies which should be passed as representing the constituents naturally occurring in the best waters. At first sight, it might appear wiser to allow a certain proportion of each constituent individually, say for instance 1 grain of chlorine or ·1 grain of nitrogen in nitrates, before the valuation; but in practice it is more convenient, and on the whole more satisfactory, to assume that if the valuation of all the constituents is less than say 15, the water is classed as of exceptional purity; and, similarly, it may be desirable to make a deduction corresponding to this figure in fixing the arbitrary limits between waters of different classes.

Fourth. Having deducted or allowed for the amount of mineral and organic constituents found in the best waters, we shall get a residual figure which will represent what may be called extraneous impurity, and this will really be the measure of the excess value of all the constituents determined, over what is present in the purest water supplies. It is practically certain that this difference, which is in fact the valuation of the extraneous impurities, will show clearly and reliably the variations which take place from week to week and month to month in the character of any one supply. But it is only by looking carefully at the details of the valuation scale that it is possible to see whether it will act with equal efficiency and certainty on supplies drawn from different sources, and on water stored or filtered in different ways.

It has been suggested that it will be necessary in some cases to make a local allowance or deduction, because of the difficulty of procuring a satisfactory water supply in certain parts of the country. The suggestion is unquestionably an important one; but it appears to me that it is preferable to report that the water of a certain district is less pure or more pure; leaving the fact of this difference of purity to be studied in a way which has not hitherto been practicable, because direct comparison of the characters of the waters has been extremely difficult.

The scale, as provisionally adopted by the Water Committee, had distinct reference to the scheme of water analysis formulated by them, and omits all reference to values to be given to organic carbon and nitrogen, and to the detailed mineral analysis, nor is any reference made to any value for the presence of heavy metals. It is obvious that some such allowance as the last is necessary, and when organic carbon and nitrogen are determined, definite values should be given to them in substitution for the values belonging to the albuminoid ammonia. The scale, as far as the purely chemical results are concerned, is as follows:—

Chlorine—·50 grn. per gallon	equal	1
Phosphoric Acid—Traces	,,	2
,, Heavy Traces	,,	4
,, Very heavy Traces	,,	8
Nitrogen in Nitrates —·10 grn. per gallon	,,	1
Ammonia, free ... —·005 ,,	,,	1
,, Albuminoid—·001 ,,	,,	1
Oxygen absorbed in 2 minutes—·002	,,	1
,, ,, 4 hours —·010	,,	1
Hardness before and after boiling (added together)—5°	,,	1
Total solid matter—5 grs. per gallon	,,	1

If any single value exceeds 10 the excess over ten is to be doubled and included in the addition. The values for the physical determinations will be found at the end of this paper.

Thus far the scale is convenient and of such a character that no analyst can have any difficulty in applying it to the results of any analysis, but as regards its application to the physical tests, viz., appearance, smell, and microscopical examination, its application is attended with more difficulty, and, as a natural consequence, more uncertainty.

While, therefore, I will consider the scale to-night in the first instance as published by the Water Committee, I shall suggest some alterations as regards these physical characters in order to render it feasible for different analysts working on their own results to obtain the same figures of valuation.

I wish to put the scale itself to a crucial test by applying it to three or four series of water analyses, and for this purpose I have had a sheet of tabulated analyses printed, the results of the physical tests being applied as accurately as is practicable.

The first series of waters to which I propose to call attention are 21 taken on the course of the Surrey Bourne, which is generally an underground river, but which has been flowing above ground during the last few months. The samples are arranged in consecutive order according to the flow of the river, commencing at the top of the watershed and following the course of the river through the whole of the valley, either on the surface or below ground, as the case may be; by taking samples from every well which is in the direct line of the flow, and by sampling the flowing river itself at several intermediate points. All the samples were drawn on the same day, commencing at the top or source of the river and following the flow of the water downwards—(Table I.)

It is obvious on the first glance at the analyses that the water is fairly pure chalk water, and applying the valuation scale to it we find that out of the 21 samples, 7 show a valuation of 27, 3 of 28, and 2 of 29, or 12 samples agree within reasonable limits, and so give what we may consider as a standard of purity for judging of the bulk of the water, and enable local or accidental contamination to be more readily discovered and valued.

We have now to deal with 9 samples which show a greater valuation than 29, and we can consider these more contaminated samples with a special advantage which does not apply to the other analyses I shall submit to you, because I have been over the whole of the course with Mr. Baldwin Latham, who has for many years studied this remarkable subterranean waterflow, and we have visited each place from which samples have been obtained, and traced out as far as practicable any possible pollution which may have occurred.

No. 1. At the commencement of the Bourne the water might be expected to be of a high standard of purity, but it is not so, and on examination we find that at the place where the sample was taken, a large number of men and animals were at work, and that the excreta and dirt to some extent were passing into the outflow and contaminating the water. Four columns of this analysis show increased values, and the differences, although small in each constituent, so small in fact as to pass almost unnoticed, yet give a valuation of 8 more than the next sample.

At No. 5 there is again an increased value, and here it is found that drainage water from cultivated and presumably manured ground is contributing to the flow. On looking at the figures of the analysis, the only changes which attract attention are the increases in the chlorine which has nearly doubled, and in the nitrogen in nitrates; the results of the microscopical examination are somewhat less satisfactory, but yet taking all the figures and giving each the increased weight which it claims, seven columns give higher figures and the valuation increases to 42.

As the Bourne flows down the valley purification to some extent takes place, but at No. 8 we come to a sudden and remarkable increase in the valuation, which rises to 47. The cause is easy to find. The well from which the sample was drawn is in close proximity to a cesspool, and consequently, although no one figure of the analysis is altered very greatly except the chlorine, seven of the constituents show an increased valuation. No single figure shows increase enough to condemn the water, but the collective figures show that the value rises from 27 to 47, and if the water is not a second class one it is so near the margin as to be viewed with suspicion.

The flowing Bourne soon seems to get rid of this contamination, and I need not refer to one slight change at No. 12, further than to say that the proximity of a farm tells on the valuation, but pass on to No. 14, where the valuation suddenly rises from 27 to 46. Chlorine is lower than in the case of the last sample we considered; the nitrates have increased very greatly; ammonia and albuminoid ammonia show very little change; but there is an increase in oxygen absorbed, and perhaps a slightly worse result from the microscopical examination. Taking all the figures, however, eight different columns of the valuation rise to tell the tale of another adjacent cesspool, and the water is at once marked as relatively polluted, although the analysis does not show any single excessively high figure.

Now these results, all obtained on the same general water flow, and for all practical purposes on the same water, with the sources of contamination thus accurately sought out, show that the broad principle of the valuation is correct, and even the figures of the scale itself are not likely to be far wrong when a cesspool or some manured fields in the neighbourhood of a flow averaging some six million gallons a day is thus distinctly indicated.

We can, with advantage, make another study from these analyses. In 13 of them, Nos. 2, 3, 6, 9, 10, 11, 13, 16, 17, 18, 19, 20, 21, we have values ranging between 27 and 30, one only reaching the latter figure. These samples being all approximately of the same quality and the same class of water, may be fairly averaged so as to arrive at the measure of condemnation afforded to each constituent.

The average value attached to the microscopical examination is 7·1 or one-fourth of the total. The microscope showed vegetable debris, animalculæ, mycelium and spores, with in one case fragments of straw and hair. These microscopical results of course are not satisfactory, and on the whole, the relative condemnation afforded by a valuation of 7·1 for them seems just.

The hardness and total solids together give an average valuation of 7·5 or rather more than one-fourth of the total. Considering that this water is on the whole a pure one, but very hard, it does not appear that this valuation of solid matters and hardness is too high.

The nitrogen in nitrates gives an average valuation of 3·7 corresponding to ·37 grains present. This proportion is of course considerably above the average of that found in public supplies; in fact, taking the March waters as reported in The Analyst, we only find four cases out of those 40 or 50 public supplies where such a large proportion was found. Therefore, although nitric acid is of less importance in a chalk water than in a shallow well water, it does not seem that the valuation assumed gives any undue relative importance to it.

The valuation for ammonia, free and saline, has been greatly increased since I originally laid the scale before the Society, but, judging from this series of analyses, it does not seem to be too high. Thus we find that the valuation of the ammonia in the whole of these 13 waters averages only ·5, and taking our May table of analyses there are only two waters which give a value exceeding 1, viz., King's Lynn 1·1, and Oldham 3·0.

Oxygen absorbed in two minutes and in four hours added together, shows an average valuation of only 1·0 on these waters; but from some other analyses, which I shall refer to later on, it will be seen that in the case of some peaty waters the condemnation value of oxygen absorbed becomes rather high, and I shall propose a modification which I think will be necessary.

We next have (Table II.) a series of hard chalk waters, two of which, viz., the supply of Canterbury in two different months, have been softened by the Clark process. In these analyses the microscopical results are almost uniformly satisfactory, and the table may be taken as very fairly representing the character of deep chalk wells through the greater part of the country.

A comparison of the analyses of the samples from Cambridge and from Canterbury will give a fair estimate of the improvement which, according to this valuation, is obtained by the treatment of a water by the Clark process. The two waters before treatment are very similar in character, whereas after treatment the valuation is lowered from 28 to 14 or 15, this result being effected by decrease in the nitrogen in nitrates, ammonia, albuminoid ammonia, oxygen absorbed, hardness, and total solids.

The first eleven waters of this series are all samples supplied by the Kent Company, or drawn from their different wells. Only two of these call for special attention, one because the valuation is low and one because it is high.

The sample from the Shortlands wells gives a valuation of only 19, and on comparing this with the next sample it will be seen that the difference of 1 in the value is accounted for by decreases in the figures in seven different columns.

The sample of Kent water supplied for February shows a higher valuation, viz., 37, and this appears to be due to increases in nine different columns of the analysis, as compared with the January analysis of the same supply, the most important change, however, being produced by large increases in the proportions of nitrogen in nitrates and albuminoid ammonia.

I now propose to make some comparisons in a different way, by considering the supplies of the companies drawing their water partly or entirely from the river Thames, illustrated by the analyses made by our members in January, March and May of this year. I include the New River in this series, because part of that water is taken from the Thames.

It appears to me, that with the generally satisfactory character of the London tables of mortality, the general state of health of the population, and last, but by no means least, the great neglect of proper sanitary precautions in the house cisterns of the metropolis, we are bound to say that London water as supplied by these different companies, must, under ordinary circumstances, be considered of first-class quality. These waters (Table III) should give us an idea of a definite limit or standard by which to define a first class water. They would give us a valuation of about 40 as that at which the limit between first and second class water should probably be drawn, and allowing for the alterations in the scale this would correspond closely with the original limit of 35 which I suggested. Two samples only out of the 18 contained in the table, show a valuation exceeding 40; while 9, or 50 per cent. show valuations between 20 and 30. In February four of the London waters exceeded this limit and in April every sample was below it.

This table may be considered in a different way from the Surrey Bourne series. All these waters have received certain and tolerably accurately known amounts of pollution, and have afterwards been subjected to oxidation, which is probably as complete as that received by most river waters. Unless, therefore, an exception is made for the Lambeth Company, which is pumping a considerable portion of its supply from the gravel, and this portion is probably different in character to the river water, these analyses must be considered and explained without the addition of any extraneous information.

The average valuation of these six companies' water during the last five months have been, Southwark and Vauxhall, 35; West Middlesex, 29; Grand Junction, 31; Lambeth, 39; Chelsea, 31; New River, 28; or taking those only included in Table III., Southwark and Vauxhall, 31; West Middlesex, 30; Grand Junction, 32; Lambeth, 41; Chelsea, 30; and New River, 29. On the average results, therefore, we have no exceptional figures except possibly in the case of the Lambeth water.

Analyses and Valuations of various Waters. All results are expressed in GRAINS PER GALLON.

	Source of Sample.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in 2 mins. at 80° Fahr.	Oxygen, Absorbed in 8 hours at 80° Fahr.	Hardness, Clark's Scale, in degrees. Before Boiling.	Hardness, Clark's Scale, in degrees. After Boiling.	Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	Valuation.
TABLE I.—Surrey Bourne Waters—	1	opqe. yelw. white chlky.	slight	1·28	traces	·315	·0017	·0020	·0020	·0272	10·4°	3·4°	30·40	minl. mttr. hair veg. deb.	35
	2	c. yellow blue	veg.&earty.	1·28	traces	·245	·0032	·0015	·0020	·0272	7·5°	2·5°	18·00	veg. deb. animal. mycelium	29
	3	c. yellow blue	none	1·42	traces	·497	·0012	·0013	none	none	13·4°	3·0°	24·60	diatoms. veg. deb.	28
	4	c. greenish	v. slight	1·42	traces	·280	·0022	·0024	·0020	·0158	12·6°	2·5°	30·00	veg. deb. fib. spores vort. hair	35
	5	c. p. blue, yellow tinge	slight	2·63	traces	·700	·0017	·0019	·0040	·0130	14·0°	3·4°	30·80	anml. algæ. veg. deb. & fib. vort. mycelium	42
	6	s. opaque yellow green	none	1·42	traces	·350	·0016	·0024	·0040	·0070	10·4°	2·7°	19·00	veg. deb. spores anim.	30
	7	c. yellow brown	none	1·13	traces	·360	·0021	·0014	none	·0330	12·9°	3·0°	26·40	veg. deb. mycelium anim. hair	33
	8	s. opqe. blue yelw. tinge	none	3·00	h. traces	·490	·0026	·0053	·0040	·0286	13·8°	3·0°	31·40	veg. deb. fibs. dms. algæ. hair	47
	9	c. yellow blue	none	1·13	traces	·350	·0018	·0019	·0020	·0014	11·0°	2·0°	23·80	veg. deb. mycelium anim.	27
	10	c. yellow brown	none	1·28	traces	·350	·0024	·0022	none	·0040	11·5°	2·5°	24·60	veg. deb. fibres anim.	27
	11	c. greenish	none	1·10	traces	·350	·0044	·0018	none	·0014	12·0°	2·6°	21·18	veg. deb. fibres anim. vorticella	27
	12	s. opqe. yelw. tinge brn.	s. veget.	1·22	traces	·350	·0019	·0027	·0040	·0158	12·2°	3·2°	24·00	veg. deb. fibres anim.	32
	13	c. greenish tinge brown	none	1·31	traces	·350	·0010	·0014	none	·0186	12·6°	3·2°	24·20	veg. deb. fibres anim.	27
	14	c. greenish	none	2·06	h. traces	1·120	·0013	·0025	none	·0400	15·4°	4·7°	33·00	veg. deb. fibres anim.	46
	15	s. opqe. greenish yelw.	none	1·50	traces	·350	·0026	·0056	none	·0100	12·0°	3·3°	24·40	veg. deb. fibres anim.	31
	16	c. blue green	none	1·28	traces	·350	·0014	·0007	·0060	·0170	11·0°	2·3°	23·00	veg. deb. fibres anim.	27
	17	c. greenish yellow	none	1·42	traces	·630	·0037	·0018	none	·0086	12·1°	2·7°	26·00	veg. deb. anim. spores	28
	18	s. opaque yellow green	none	1·42	traces	·280	·0018	·0019	none	none	11·0°	3·3°	22·00	veg. deb. fib. spores anim.	29
	19	c. yellow green	v. slight	1·28	traces	·350	·0013	·0008	none	none	12·0°	2·7°	22·00	veg. deb. fibres anim. hair	28
	20	c. greenish blue	none	1·42	traces	·330	·0039	·0013	none	·0040	12·0°	2·5°	22·40	veg. deb. fib. anim. sprs. straw	27
	21	c. greenish tinge brown	slight	1·35	traces	·336	·0013	·0017	none	·0070	11·2°	2·7°	20·80	veg. deb. fibres anim.	27
TABLE II.—Deep Chalk Well Waters—	Kent Bath Well	c. pale blue	none	1·77	traces	·420	·0003	·0013	none	·0160	20·8°	5·4°	28·80	satisfactory	23
	„ Crayford Well	c. pale blue	none	1·63	h. traces	·371	·0020	·0025	none	·0100	17·9°	5·7°	25·80	satisfactory	25
	„ Garden Engine Well......	c. pale blue	none	1·77	traces	·480	·0009	·0018	none	·0210	23·4°	7·4°	33·40	satisfactory	27
	„ Orpington Well	c. pale blue	none	1·20	traces	·428	·0015	·0025	none	·0080	17·9°	4·0°	22·20	satisfactory	21
	„ Plumstead „	c. pale blue	none	2·84	none	·434	traces	·0009	none	·0200	23·3°	9·3°	35·20	satisfactory	26
	„ Shortlands „	c. pale blue	none	1·20	none	·308	traces	·0045	none	·0120	17·0°	3·2°	22·00	satisfactory	19
	„ Twinswell „	c. pale blue	none	1·77	none	·539	·0039	·0014	none	·0160	21·3°	6·9°	25·40	satisfactory	23
	Jan. Kent	p. blue	slight	1·35	none	·300	·0009	·0033	·0040	·0100	16·8°	3·8°	20·05	vegetable debris	23
	Feb. Kent	greenish	v. slight	1·84	none	·848	none	·0087	none	·0340	17·4°	4·5°	30·00	satisfactory	37
	March Kent	c. pale blue	none	1·91	traces	·350	·0016	·0033	none	none	14·8°	4·2°	32·80	satisfactory	23
	April Kent	c. blue green	none	2·13	traces	·440	none	·0033	none	·0098	21·6°	8·5°	33·00	satisfactory	27
	Jan. Cambridge	f. blue	none	1·57	h. traces	·403	·0007	·0021	·0039	·0616	18·5°	6·0°	24·50	satisfactory	31
	April Cambridge	c. p. blue	none	1·47	traces	·510	·0014	·0010	none	·0154	19·0°	4·5°	25·20	satisfactory	23
	Jan. Sevenoaks	colourless	none	1·22	traces	·266	·0060	·0010	·0010	·0330	13·1°	3·8°	19·88	satisfactory	14
	March Sevenoaks	c. colourless	none	1·31	traces	·315	·0014	·0007	·0028	·0101	15·0°	3·9°	19·88	satisfactory	15
	Jan. Canterbury..........	c. blue	none	1·47	none	·346	·0006	·0008	·0040	·0080	7·0°	4·0°	10·64	traces mineral	20
	April Canterbury..........	p blue	none	1·47	none	·340	·0005	·0007	·0050	·0110	5·0°	4·5°	10·36	traces mineral	20

TABLE III.—Thames and other London River Supplies	Jan.	Southwark and Vauxhall	p. yellow	none	1·24	traces	·169	·0005	·0050	·0020	·0440	17·5°	5·0°	23 80	satisfactory	28
	March	Southwark and Vauxhall	s. yellow	none	1·24	traces	·116	·0012	·0070	·0022	·1100	17·0°	5·5°	21·28	v. s. mineral	39
	May	Southwark and Vauxhall	v. p. greenish yellow	none	·96	traces	·120	·0012	·0091	·0040	·0537	14·0°	3·0°	19·64	mineral diams. & infusoria	36
	Jan.	West Middlesex	c. yellow	none	1·09	traces	·260	·0013	·0060	·0050	·0860	18·0°	4·6°	23·44	amorph. organic matter	39
	March	West Middlesex	f. yellow	none	·98	traces	·174	·0003	·0030	·0030	·0920	14·8°	4·2°	20·82	satisfactory	29
	May	West Middlesex	yellowish	none	1·04	traces	·180	·0007	·0020	none	·0400	13·5°	3 5°	18·37	satisfactory	21
	Jan.	Grand Junction	f. yellow	none	1·12	traces	·125	·0011	·0053	·0038	·0488	15·1°	4·0°	21·80	none	28
	March	Grand Junction	p. yellow	none	1·26	traces	·176	·0011	·0061	·0084	·1135	14·8°	4·8°	20·00	satisfactory	39
	May	Grand Junction	p. yellow	none	1·06	traces	·121	·0006	·0039	·0064	·0380	13·3°	3·8°	19·40	none	28
	Jan. 7	Lambeth	mkd. yellow	slight	·96	traces	·157	·0007	·0070	·0047	·1250	17·0°	4·8°	24 50	veg. deb. mvg. organisms	52
	March	Lambeth	yellow	none	1·24	traces	·098	·0002	·0092	·0067	·1142	15·0°	5·5°	21·56	minl. mttr. mvg. organisms	46
	May	Lambeth	v. p. green yellow	none	·99	traces	·140	·0014	·0040	·0022	·0530	14·0°	3·0°	19·86	s. mineral & diatoms	28
	Jan.	Chelsea	greenish yellow	none	·95	h. traces	·146	·0010	·0062	·0056	·0700	16·5°	7·5°	23·24	none	35
	March	Chelsea	greenish yellow	none	1·20	traces	·140	none	·0050	·0100	·0730	14·0°	3·5°	21·00	satisfactory	33
	May	Chelsea	p. greenish brown	none	·89	traces	·080	·0010	·0035	·0030	·0390	13·0°	3·0°	17·64	good	22
	Jan.	New River	c. f. tint	none	·84	traces	·293	·0020	·0010	·0020	·0310	14·4°	4·1°	23·80	none	23
	March	New River	c. f. yellow	none	1·10	traces	·227	·0028	·0049	·0014	·0973	14 9°	5 0°	21·42	satisfactory	31
	May	New River	c. f. yellow	none	1·01	traces	·161	·0014	·0035	·0042	·0560	13·6°	3·2°	17·92	satisfactory	24
TABLE IV.—Waters from Millstone Grits, Peaty Ground, &c.—	March	Whitehaven	f. green	none	·37	none	·014	none	·0021	none	·0030	·4°	·4°	2·20	veg. deb. diatoms	9
	May	Whitehaven	c. f. green	none	·38	none	·013	none	·0007	none	·0125	·4°	·4°	2·19	veg. deb. diatoms	9
	March	Derby	v. good	none	·85	none	·221	trace	none	trace	·0154	13·2°	5·9°	18·20	satisfactory	12
	May	Derby	v. good	none	·90	s. trace	·074	·0007	·0010	none	·0027	11·1°	4·4°	16·59	satisfactory	12
	Jan.	Manchester	s. turbid	peaty	·75	traces	none	·0025	·0040	·0053	·0516	1·9°	1·7°	4·75	none	21
	March	Manchester	s. turbid, f. yellow	none	·61	none	none	·0027	·0038	·0107	·0860	1·3°	1·2°	4·69	satisfactory	23
	May	Manchester	yellow green	none	·86	none	none	·0029	·0042	·0108	·0602	1·7°	1·6°	5·25	s. mineral	21
	Jan.	Leeds	light brown	peaty	·62	traces	none	·0003	·0030	·0200	·1100	5·2°	2·9°	6·44	sand peaty matter	40
	March	Leeds	light brown	none	·49	traces	none	·0005	·0030	·0140	·1204	4·0°	2·9°	5·04	peaty matter	36
	May	Leeds	yellow brown	none	·74	traces	none	·0003	·0031	·0140	·1344	3·6°	3·0°	5·04	peaty matter	40
	Jan.	Bradford	f. dirty yellow	none	·75	none	none	none	·0070	·0168	·1400	4·2°	3·7°	7·80	none	40
	March	Bradford	peaty yellow opaque	none	·70	none	none	none	·0042	·0260	·2300	4·2°	3 9°	7·30	none	65
	May	Bradford	s. yellow opaque	none	·75	none	none	·0007	·0063	·0300	·1700	4·0°	3·7°	7·20	none	57
	March	Liverpool	yellowish brown	peaty	1·22	traces	·093	·0008	·0033	·0084	·1400	5·2°	5·0°	9·52	satisfactory	41
	May	Liverpool	greenish yellow	peaty	1·08	traces	·077	·0028	·0042	·0056	·0912	4·6°	4·4°	8·40	satisfactory	31
TABLE V.—Sundry Waters not previously published—	A.	Deep well	bright green yellow	none	2·40	traces	·300	·0027	·0048	·0020	·0360	15·6°	15·4°	18·00	satisfactory	33
	B.	Shallow well	green blue	slight	1·86	traces	·200	·0043	·0045	none	·0760	13·4°	12·8°	32·00	satisfactory	36
	C.	Well	dirty yelw. grn. s. opqe.	none	1·60	traces	·300	·0085	·0113	none	·0080	4·0°	3·0°	8·60	veg. deb. mycelium fibres sand	38
	D.	Well	dirty yellow s. opaque	slight	2·40	h. traces	·400	·0015	·0086	none	·0600	11·0°	5·2°	20·40	satisfactory	41
	E.	Well	green brown opaque	none	4·47	h. traces	·500	·0021	·0075	·0050	·1190	22·0°	12·0°	50·70	satisfactory	63
	F.	Shallow well	bright yellow green	s. veget.	6·23	h. traces	·700	·0010	·0104	·0040	·0240	28·6°	26·8°	49·40	veg. and other debris	73
	G.	Well	greenish blue clear	none	6·72	traces	·200	·0801	·0119	none	·0540	14·2°	12·0°	44·80	veg. deb. spores	82
	H.	Well	dirty yelw. grn. s. opqe.	none	6·74	v. h. traces	·900	·0078	·0079	·0060	·0540	29·0°	14·0°	67·80	veg. deb. mycelium	89
	J.	Shallow well	c. p. blue	none	6·68	traces	2·000	·0009	·0118	·0020	·1020	7·7°	7·7°	42·10	veg. fibres & leaves	89
	K.	Deep	dirty yelw. grn. v. opqe.	veget. mttr.	4·50	h. traces	·500	·0195	·0101	·0020	·4130	16·0°	6·7°	37·90	fib. anl. hair qtz. sand veg. deb.	133
	L.	River	opaque yellow brown	offensive	1·47	h. traces	·750	·0013	·0413	·0020	·3040	18·0°	1·5°	28·60	anim. cott. fib. mycelium hair	166
	M.	Deep well	yellow brown opaque	decided	35·10	traces	·200	·0130	·0134	none	·0860	16·0°	5·2°	66·20	veg. deb. fib. spores anim. &c.	198
	N.	Deep well	yellow brown opaque	v. slight	42·12	h. traces	·450	·0011	·0090	none	·0680	17·6°	10·4°	78·00	veg. deb. spores fibres anim.	218
	O.	Public Supply from Brook	yellow brown v. opaque	s. veg. mttr.	10·28	h. traces	·600	·0102	·0763	·0060	·4480	14·4°	8·9°	52·60	veg. deb. much decomp. anim.	300

Averaging the values given by each separate constituent we get the following: Appearance has an average valuation of 2. As a reason for this, in every case except one, we have a yellow or yellow green tint. In the other case there is a greenish brown tint. The smell has been reported as sensible in only one case, and therefore the average is too small to notice.

The chlorine has a value of 2·1, and varies very slightly in the different samples from a maximum of 2·5 to a minimum of 1·7. With one exception, phosphoric acid is returned as traces, and therefore takes an average value of 2.

Free and saline ammonia varies from ·0028, which occurred once in the New River water, to none in the Chelsea water, and the average valuation amounts to only ·2. Albuminoid ammonia varies from ·0092 in the Lambeth water to ·0010 in the New River, and gives an average valuation of 5.

Oxygen absorbed in two minutes varies from ·0010 in the Chelsea water to none in the West Middlesex, and gives an average valuation of 2. Oxygen absorbed in four hours varies from ·1250 in the Lambeth to ·0310 in the New River, and gives an average valuation of 1·4.

The hardness, which may be taken as 15° before boiling and 4° to 5° after, gives an average valuation of 3·8. The total solids value at 4·2, and the microscopical examination at 1·5.

These 18 analyses give us, therefore, another fair basis on which to estimate the equivalence of the different parts of the scale, and they confirm the impression that the oxygen absorbed in two minutes is over valued, and the free ammonia rather under valued. There appears some reason to think, as regards the oxygen absorbed, that the increased temperature at which the determinations are now being made has told more on the figures than was expected.

It is noteworthy that in these samples the microscopical examination has not shown any serious results, but has on the whole given satisfactory indication of the character of the water.

This table may be considered in another way by selecting the worst waters and comparing their figures. Thus it will be seen that the Southwark and Vauxhall water for March shows an increased valuation over January in the proportion of 39 to 28. This is accounted for by increases in the ammonia, albuminoid ammonia, oxygen absorbed in two minutes and four hours, hardness and microscopical results, or six different determinations.

The West Middlesex for January gives a valuation of 39, and for March of only 29, which is accounted for by changes in the chlorine, nitrates, ammonia, albuminoid ammonia, oxygen absorbed in two minutes, hardness, total solids, and microscopical results, or eight determinations.

The Grand Junction shows a valuation of 39 for March, and 28 for January, a difference accounted for by increases in the chlorine, nitrates, albuminoid ammonia, oxygen absorbed in two minutes and four hours, and hardness, or six determinations in all.

The Lambeth water for March has a valuation of 46, and for May of 28. The difference is accounted for by changes in the chlorine, albuminoid ammonia (which shows a very large difference) oxygen absorbed in two minutes and in four hours (which also shows a very large difference) hardness and total solids, or six different determinations.

The Chelsea supply gives a valuation of 33 for March and 22 for May, and this difference is accounted for by increases in the chlorine, nitrates, albuminoid ammonia, oxygen absorbed in two minutes and four hours, hardness and total solids, or seven determinations.

The New River for March shows a valuation of 31, and for May of 24, and this is made up by differences in the chlorine, nitrates, ammonia, albuminoid ammonia, oxygen absorbed in four hours, and hardness, or six determinations in all.

Therefore, in no case out of these 18 analyses is this increased condemnation dependent on less than the results of half-a-dozen determinations. It is consequently clear that this increased value represents an increase of extraneous impurity.

We will next consider 18 samples from sandstone, &c., which are included in the monthly returns for January, March and May (Table IV). These figures enable us to note another new feature in the valuation scale. The supplies of Whitehaven and Derby rank according to the scale among the purest of any that have been reported upon in the monthly analyses. The valuation of Whitehaven is 9 for March and May, and of Derby 12 for each month. Looking at the figures in the Whitehaven water in detail, we find that only two determinations in each of the analyses give a valuation exceeding one, viz., the microscopical examination, which in both cases show vegetable debris and diatoms, the albuminoid ammonia for March which gives a valuation of 2·1, and the oxygen absorbed in four hours for May, which values at 1·2.

Taking now the Derby water, we have four columns of the analyses, viz , the appearance, smell, oxygen absorbed in two minutes, and microscopical examination, which give simply negative results. The highest figures in the valuation are contributed by the hardness, which gives 3·8 and 3·0, and the total solids which show 3 6 and 3·5. The nitrates for March have a valuation of 2·2, and the chlorine for the two months 1 6 and 1·8 respectively.

From these analyses I obtain a limit for what may be called unavoidable impurity. It is indeed roughly, the degree of contamination of the most pure public supplies, and 15 seems a fair figure to take for this. Assuming, therefore, that 40 is adopted as the limit of first class water, and 15 as that of water of *exceptional purity*, it will be probable that 65 is a fair limit for a second class water, since it will allow for twice as much *extraneous contamination.*

From these exceptionally pure water supplies, I will pass to those slightly more contaminated, taking Manchester first. At a glance it is evident that the general supply of this town is good, and if the valuation figures are a clear indication, as I contend they are, it is uniform in character. I attach great importance to this uniformity. We find that January, March and May show valuations of 21, 23 and 21 respectively, while the intermediate months not included in the table give values of 22. It is evident that no deductions can be drawn from the variations in the character of this water, but for comparison we will see how it differs from the Whitehaven supply, because although the Manchester water is of good quality, it shows a valuation rather more than twice as high as Whitehaven.

The Manchester water was in two cases turbid, and in the third had a yellowish tint in addition to the green; this increases the valuation. In one case there was a peaty smell which also adds a fraction. The chlorine gives an average of ·76 as against ·37 in the Whitehaven water, or nearly twice as much, and shows an increased value of ·7. Phosphoric acid was present in one case, but absent in both Whitehaven samples. Nitrates shows a very small decrease of ·1 which is more than counter-balanced by the increase in ammonia, which amounts to ·5. Albuminoid ammonia shows an increase of 2·4; oxygen absorbed in two minutes an increase of 4·5, and in four hours of 5·9, and total solid matter an increase of ·5, the microscopical examination showing a decrease. Thus we have nine columns in which the results are somewhat less satisfactory, and only two in which there is any indication of improvement. This gives a fairly conclusive indication that the increased valuation—though it certainly cannot be called condemnation—is fairly earned by the water.

Assuming 40 to be the limit for first class waters, the water supply of Leeds ranges very close to that number. We find the appearance and smell, phosphoric acid, and nitrates are practically the same as Manchester. The chlorine shows a small diminution of ·2; ammonia a decrease of 4, and albuminoid ammonia of 1; while the oxygen absorbed in two minutes gives an increase of 3·5; and that absorbed in four hours an increase of 11; the hardness of nearly 1, and the microscopical results of 5.

Now, in this case it is clear that the apparent increase of impurity is due almost entirely to the presence of vegetable matters, which, without doubt, are of a peaty character. If a peaty water is to be passed as satisfactory for a public supply, the condemnation afforded by the values given to the oxygen absorbed, and to the microscopical results is somewhat too great, but the water is certainly less pure than the Whitehaven and Manchester supplies; and what is of paramount importance, and is so pointed out by the value, is the fact that the water is not properly oxygenated.

Going one step further, we take the Bradford water. This also is peaty in character, and as regards its proportion of albuminoid ammonia does not differ to any noteworthy extent from the Leeds supply, but the total valuation runs up considerably. The change is due partly to a change in the colour, partly, though to a small extent, to an increase in the albuminoid ammonia, but very greatly to an increase in the amounts of oxygen absorbed in two minutes and four hours, the former of which shows an increased valuation of about 12 and the latter of 25. The hardness and total solids exercise very little influence on the total value. The condemnation here is marked and due almost entirely to the large amount of oxygen absorbed, *i.e.*, to defective æration. Therefore, this water might probably be much improved by mechanical agitation, such as a waterfall, or by the diminution of the growth which possibly exists in the large reservoirs.

Taking, therefore, these 18 waters all drawn from collecting grounds *supposed* to be free from any direct contamination with excreta, and only containing different proportions of peaty and other vegetable matter, the scale is found to be a practical and satisfactory one, and, if it errs at all, it is to make the condemnation of an impure water rather more emphatic, while it brings out in the clearest possible way the purity of such supplies as those of Whitehaven and Derby.

But even these three series of analyses are not sufficient in my opinion to fully confirm the value of the scale, and we will consider next some waters taken at random as they have come in for ordinary analysis, four of them being supplies of large towns not included in our monthly reports (Table V). These are purposely selected as being on the whole of less satisfactory character, and in order to show the way in which the scale works they are arranged in the order of their values. This renders it easy to view them again from another point of view, and we will take first the our waters—A, B, C, D—which each show a value of less than 50.

A is from a deep well in a district not very largely populated, and shows only one determination (the hardness), which has a valuation exceeding 5. No figure of the valuation indicates heavy organic contamination, and the water passes well within first class.

B is from a shallow well. The proportion of oxygen absorbed shows a higher figure, the other figures of the analyses being fairly identical, except total solids.

Passing over the next three analyses as being of little moment except for comparison, I come to G, H, and J, which give values of 82, 89, and 89. They may fairly be looked at together. The chlorine in each is high, and gives values of 16·4, 16·9, and 16·4 respectively. The valuation for phosphoric acid in one case is eight. The nitrates in J, which is a shallow well in the sandstone, rise to 30, a figure which in itself, without the other details of the analyses being considered, is almost condemnatory.

In G the free ammonia values at 22, the albuminoid ammonia in that sample values at 13·8, and in the next at 13·6. The highest value reached by the oxygen absorbed is 10·4 in J, and the highest value for total solids is 17 in H, which contains 67·3 grains of total solid matter per gallon. The microscopical results acquire no undue weight, as the highest value is 6.

Looking at the three samples as a whole, 20 out of the 36 valuations exceed 5, and eight of them exceed 10. It will be found as a general rule that any single valuation which exceeds 5 is undesirable, and that any valuation which exceeds 10 casts grave suspicion upon a water, and these three analyses bear out that statement very closely.

Again, passing over one or two intermediate analyses, we will consider M, N, O, which are all waters from chalk wells comparatively near to the sea-shore, but in one case at least (O) inspection on the spot proved that surface drainage from cultivated land and from an adjacent farmyard enter to a considerable extent. In the other two samples, drainage water from arable land has been proved to find its way into the leaky water tubes. The valuations of these three waters are respectively 198, 218, and 300, and, therefore, if the valuation scale is of any good at all, these waters are unfit to drink. They differ in character very considerably, and afford another and very fair standpoint from which to judge the scale. The appearance in each case gives a value of 6. In M the chlorine has a value of 130, in O of 30, and in N of 154. If salt is objectionable in a drinking water, we have it here in such quantity that two of the waters are condemned by the proportions of chloride of sodium, independently of any other constituent in the analyses. These proportions, which are 42 grains per gallon in N, and 35 grains in M, are, of course, quite sufficient to render the water, when warmed, distinctly saline and insipid to the taste.

Phosphoric acid is valued at from 4 to 2 in the three samples, and nitrates range as high as 6. Free ammonia in M gets a value of 2·6, while in O the albuminoid ammonia shows ·0763, and has a value of 143, which is probably quite sufficient in the opinion of every analyst who has ever used the albuminoid ammonia process to condemn the water, whether a valuation scale be used or not.

The oxygen absorbed in four hours in O, the least saline water of the three, has a value of 80·6, tallying to some extent in its degree of condemnation with that due to the albuminoid ammonia. The total solids of course show a high value.

Now these waters, although emphatically condemned, are so condemned on a less number of different items than is the case in some other instances. In N and M only six columns in each case get a higher value than 5, and in O only eight columns get a higher value than that, but against this must be set the fact that we have in each sample one valuation exceeding 130. The condemnation is severe, but surely not unjust for such a figure as this.

One more series of waters I must take for the purpose of comparison, and these are the May waters analysed by the members of the Society, the analyses of which appeared in the June number of THE ANALYST. It is unnecessary to go at detail through these, especially as some have already been referred to, but it is worth while to consider some three or four of the most pure and three or four of the most impure ones.

The Bath water for May shows a valuation of 11, and only two of the determinations reach 4, viz., the hardness and total solids. The scale clearly applies well to that water.

The Hull water values at 14, only one figure, the total solids, reaching 4. There is no trace of organic impurity, and that water evidently is justly passed as of first class quality.

Llandrindod again gives a total valuation of 10, and only one determination, the hardness, exceeds 3 in value.

We will now consider three cases where the valuations exceed 50, viz., Greenock, with a valuation of 94; King's Lynn, of 106; and Dudley, of 55. Bradford has already been dealt with.

Taking Dudley first, the condemnation is based mainly upon the excessive amount of oxygen absorbed in four hours, viz., ·1834, valuing at 29. If the figures stood alone, we might be almost inclined to doubt the desirability of condemning water upon it, but the same determination for March gave 1, which is quite sufficient to show that the water is non-ærated, and this result coupled with the other figures is sufficient to take the water out of the possible pale of first class.

At Greenock again the condemnation is due more to the proportion of oxygen absorbed than to any other figure, the amount absorbed in four hours reaching ·2550, valuing at 41. We have no previous analysis of this water for comparison, and therefore must deal with it on its merits. It is evident that the water is lamentably non-oxygenated, and despite its softness and tolerably moderate amount of nitrogenous compounds, except as albuminoid ammonia, it does not seem at all too strong to say that the water is unfit to be used as the public supply of any town.

The King's Lynn water is valued at 106, and the condemnation is made upon the albuminoid ammonia, with a valuation of 14, and the oxygen absorbed in two minutes and 4 hours with a valuation of 15 and 46 respectively, and every other constituent in the analysis, except the free ammonia, gets a value of from 3 to 4. The water is therefore what may be best described as bad all round. The colour, smell, phosphoric acid, nitrates, albuminoid ammonia, and the microscopical results are all unsatisfactory. Looking at this, therefore, 106 is not at all too high a condemnatory value for the water which must be described as a bad third class one and unfit to be supplied to any town for drinking water.

I think I have now tested the scale as it exists, and is in use in the most exhaustive manner practicable within the time at our disposal, and it only remains for me to see what alterations are practicable or desirable. The main change necessary certainly seems to be in the valuation given to the oxygen absorbed.

When I first proposed the scale three years ago it was not contemplated to maintain the water at a temperature of 80°, while the permanganate solution was acting, or to increase the duration of the test. This increase of temperature increases the relative power of the permanganate, and I think the result of the comparison of all the figures shows that, if the valuation for the two minutes determination is allowed in future for the absorption which takes place in 15 minutes instead of 2, a more just opinion on the character of a water will be arrived at.

The free ammonia valuation may need increase so as to allow 1 for every ·002 grain per gallon, but I prefer at present to leave this unaltered till longer experience shows if it is needed or not.

These are the only two alterations which I think really desirable in the chemical part of the scale, but one other point has to be considered. The microscopical examination takes, as at present arranged, a maximum valuation of 10. This value is not high enough to be given to that determination by an analyst in the daily habit of using the microscope, and that and some of the other physical determinations should have an increased value. I, therefore, propose the following amplified scale, as regards the physical tests coupled with the slight amendment of the chemical valuations, which consists in giving the same value to oxygen absorbed in 15 minutes as has been previously taken by that absorbed in 2 minutes.

I give the figures in the order in which they appear in our monthly reports. It is, of course, obvious that the microscopical valuation is merely an outline, the details of which must be subsequently filled up.

Appearance in 2-ft. tube.		
C. blue		0
C. pale yellow		2
C. green		2
C. dark yellow		4
C. dark green		4
Suspended matter to be added to valuation of appearance.		
For traces		1
,, heavy traces		2
,, turbidity		4
Smell when heated to 100° F.		
Vegetable matter		1
Strong peaty		2
Offensive, of animal matter		4
Chlorine in Chlorides	50 grs. per gal.	= 1
Phosphoric acid as phosphates.		
Traces	= 2 h. traces = 4 v. h. traces	= 8
Nitrogen in Nitrates	·100 gr. per gal.	= 1
Ammonia	·005 gr. ,,	= 1
Albuminoid Ammonia	·001 gr. ,,	= 1
Oxygen absorbed in 15 minutes at 80° Fah.	·002 gr. ,,	= 1
,, ,, 4 hours ,, ,,	·010 gr. ,,	= 1
Hardness before and after boiling added together	5°	= 1
Total Solid Matter	5 grs. per gal.	1
Heavy Metals	S. traces	= 6
,, ,,	H. ,,	= 12

Microscopical results.

Vegetable debris in small quantity	4
,, ,, large ,,	8
Diatoms and Bacteria in small quantity	6
,, ,, large ,,	12
Hairs, and animal debris	10 to 20, according to the quantity observed.

Mr. Wigner concluded by moving "That a water valuation scale analagous to that which has been suggested be recommended by the Society for the adoption of its members."

Dr. Muter said that, to place the matter fairly before the Society, he thought it very desirable that they should first of all debate the general question, viz.: Were or were they not to have a valuation scale for water analyses. He himself believed thoroughly in the fundamental principles of such a scale as that so ably put before them that evening by Mr. Wigner, but there might be gentlemen present who did not share that belief, and they would have an opportunity on the present motion of bringing forward their views, and should they be, as he hoped, rejected by the meeting, then it would be desirable to discuss the items of the scale *seriatim*. He therefore, without further occupying time at that stage of the proceedings, begged to second Mr. Wigner's motion.

Mr. Lyte said no one could fail to be struck with the great meed of truth that there was in Mr. Wigner's scale, and the members would, he thought, be inclined to agree that a scale be adopted on that basis.

Mr. Thomas moved as an amendment "That it is premature to adopt any fixed water valuation scale at present and that it be not considered." He said that one of the reasons why he opposed the adoption of the scale was that a peaty water (Bradford water in Table IV.), which he considered a good water, was valued at 65; whereas if one knew the previous history of a water and that was unfavourable, he would have no hesitation in condemning it, although its valuation was below 65. He for one would never pledge himself to use the scale. It was not for the Society to *adopt* anything, and it was entirely out of harmony with the constitution of the Society.

Mr. Hehner seconded the amendment and said they must first know the history of the waters with which they had to deal, and then apply the scale. If they did not know the history the scale was absolutely useless. Water containing a good deal of chlorine would be rejected and yet it might not be a bad water at all. Chloride of sodium did not do any harm if it were not derived from pollution. He thought it was impossible to adopt a scale unless the analyst knew what water he had under his hand, and if he did know there was no need to adopt any scale.

Dr. Dupré said he should be sorry to meet the proposal with a direct negative because he was fully convinced that Mr. Wigner had gone into the matter very carefully, and that the valuation scale really on the whole followed very closely what would be the general opinion on a given water. At first sight there appeared to be discrepancies, for instance, the value attached to albuminoid ammonia seemed far too low in any given water. On closer examination it would, however, be found that where the albuminoid ammonia was high that was never the only thing which was high; it was always accompanied by certain other constituents that increased the value, and therefore the value of the albuminoid ammonia was really that of the albuminoid ammonia plus the other constituents that increased simultaneously, and therefore he believed the scale had on the whole been remarkably well adjusted. At the same time he was not prepared for the Society to adopt it yet, and should be inclined to propose that the scale be provisionally used in the monthly table published in The Analyst so that they could see it in print.

Mr. Dyer said that in many cases the scale might be valuable, and especially for private use, but he certainly should not like to see the Society pledged to the adoption of any scale.

On the amendment being put it was rejected.

Dr. Dupré then moved as an amendment "That such a scale be provisionally used and that the figures be published with the published water analyses of the Society until the end of this year," and said he was quite of opinion that it was premature to definitely adopt a scale at present, but he had faith enough in the scale to think that it ought to get a fair trial, and it would never get a fair trial unless a number of analyses were published with the values attached. For himself, he had gone into the scale now and then, and was convinced there was something in it. He had before expressed his opinion that the scale should be improved by raising the valuation of a particular constituent if accompanied by something else—if for example, albuminoid ammonia were accompanied by a certain proportion of nitric acid, to increase the valuation attached to albuminoid ammonia. The same with chlorine : for a certain amount of nitric acid together with chlorine, increase the ordinary value attached to nitric acid, so that a polluted water would probably come out higher than in the present case.

In the case of ammonia, Mr. Wigner had proposed that it should be doubled. He had just had four waters from deep wells, some over 500 feet deep, remarkably pure waters as regards albuminoid ammonia and oxygen absorbed, in fact, all but perfect in these respects, but three of them contained something like ·08 parts of ammonia, which would alone give a valuation of 70 on the altered scale. In other words, it would bring what was a really first class water down to a third class one. He thought that showed that the valuation of any particular constituent should be to some extent governed by the rest of the constituents. In waters as perfect as these were, the valuation of ammonia should be very low. If on the other hand, they had a water which showed that it was really a polluted water, the value put on ammonia should be high.

The next difficulty was the oxygen absorbed. That also he thought ought to be governed by something beside itself. It was perfectly clear that a water contaminated by animal matter which absorbed a given amount of oxygen should have a very much higher value attached to the oxygen than a peaty water. A peaty water might not be a pleasant water to drink or look at, but no one had a right to say that it was a dangerous water. If by means of the oxygen absorbed they condemned such a water, they laid themselves open to severe and very just criticism. The oxygen therefore should be governed by something else. No nitric acid being present the oxygen must be valued low, but with nitrates present it must be valued high.

Dr. Tripe, in seconding the amendment, remarked upon the figure 10 being fixed as the maximum valuation of the whole of the microscopical results, including bacteria, infusoria, cotton and other fibres, muscular tissue and epethelial debris, and said that if he understood aright a peaty water might have a valuation of 80 attached to it because of the quantity of oxygen absorbed, and 10 only put for the whole of these evidences of direct sewage contamination. He therefore objected to that number and considered it ought to be enlarged by so much being given to epithelium, muscular fibre, vibrions, and so on. Microscopists could not at present invariably distinguish between some forms of innocent bacteria and those which would cause disease, and yet a valuation of 10 only was given to bacteria which might spread typhoid, summer diarrhœa, or some other form of disease. And therefore bacteria and other things showing direct sewage contamination should be valued higher.

Dr. Dupré deprecated putting a prohibitory value to any particular constituent, and doubted very much whether a water was ever found with bad microscopical results where all the other results were not bad too.

Dr. Muter said that were the original motion, which he still urged on their consideration, carried, he should have moved the omission at present of any valuation being given to physical characters, such as colour, odour and microscopic appearances, because those must always be a matter of opinion, and he thought that only definite chemical points for which they could get figures should be at present considered. At the same time he was not to be taken as detracting from the importance of these indications in experienced hands. The point from which they ought not, however, to wander was—is there to be a scale or not, and he hoped that they would not part without coming to a definite decision on this broad principle, favourable to the adoption of a scale. He did not think that it was desirable to ask The Analyst to take a responsibility, which the Society as a whole dreaded to assume, and this being the tendency of Dr. Dupré's amendment he could not accept it, but still pressed the original motion of Mr. Wigner on the notice of the meeting.

Mr. Heisch said that as far as he understood Dr. Dupré he did not wish the consideration of the subject postponed indefinitely, but to have the results of the valuation scale as applied to the waters analysed by the members of the Society published with the analyses every month. He thought that if this were done, and analysts would give anything like a definite account of the microscopic examination, they would at the end of six months be better able to judge of the scale than at present. He had a very great belief in the value of microscopic examinations, not only of the deposit from water but also of the residue of the evaporation of a drop on a slide and was always much guided by these in his estimate of a water, but at present was not prepared to give a definite value to each individual object found.

After some other remarks Dr. Dupré's amendment was put and lost.

The discussion having extended to an unusually late hour,

Dr. Tripe then proposed, and Mr. Allen seconded, another amendment, "That the further consideration of the matter be adjourned till the first available meeting in January next."

This was carried, and the discussion was adjourned accordingly.

Instructions for Water Analysis.—On page 131 we print a further part of these Instructions.

PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION OF THE ANALYSES PUBLISHED IN THE ANALYST ACCORDING TO THE SCALE REFERRED TO IN MR. WIGNER'S PAPER.

SUPPLIES.	January.	February.	March.	April.	May.	June.	SUPPLIES.	January.	February.	March.	April.	May.	June.
Kent Co.	22	42	28	30	32	23	Liverpool	..	37	41	36	31	34
New River	23	36	31	26	24	18	Llandrindod	..	18	11	..	10	..
East London	45	37	26	23	28	36	Maidstone Water Company	..	..	49	34	30	42
Southwark and Vauxhall	27	42	39	32	36	30	,, Public Conduit	..	..	43	32	30	40
West Middlesex	34	43	25	23	21	31	Manchester	21	26	23	22	21	19
Grand Junction	26	32	41	28	28	25	Newark	..	60	..	26	32	..
Lambeth	47	48	46	27	26	29	Newcastle-on-Tyne	37	40	39	34	33	38
Chelsea	34	36	31	34	22	26	Norwich	36	37	40	23	48	32
Bath	..	..	..	14	11	11	Nottingham	..	..	26	50	47	32
Birmingham	30	34	32	32	35	33	Oldham	34	..	..	20	15	..
Bradford	40	65	51	47	57	58	Plymouth	..	38	31	18	..	..
Brighton	..	20	27	22	26	26	Portsmouth	..	37	36	29	20	27
Bristol	..	29	22	27	22	19	Reading	..	37	23	25	20	20
Cambridge	31	25	26	23	32	29	Rochdale	..	..	..	9	10	8
Canterbury	15	18	18	19	16	15	Rugby	..	..	30	35	42	58
Croydon	32	37	28	19	20	28	Salford	12	12	21	27	18	21
Derby	36	20	15	18	12	14	Sheffield	22	25	20	20	20	..
Droitwich	..	42	83	..	42	..	Shrewsbury	22	37	24	20	20	18
Dudley	..	33	47	..	55	..	Southampton	..	31	50	39	41	50
Edinburgh	..	25	30	40	21	25	Stockport	..	..	14	20	18	..
Exeter	17	28	16	20	17	18	Stourbridge	..	38	30	..	44	..
Grantham	25	..	29	26	25	30	Stourport	..	32	23	..	26	..
Huddersfield	17	25	35	23	21	20	Sunderland	25	28	24	23	24	..
Hull	21	27	23	26	20	20	Swansea	..	16	12	17	21	12
King's Lynn	60	76	89	103	106	131	Warwick	35	..	31	..	37	..
Leamington	28	30	..	..	..	21	Whitehaven	..	13	10	4	7	11
Leeds	37	45	30	26	40	34	Wolverhampton	..	65	49	37	35	42
Leicester	..	63	61	27	27	30	Worcester	..	64	61	48	47	..

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE WATER SUPPLY OF PHILADELPHIA, U.S.A.

To the Editor of "The Analyst."

Sir,—I send herewith a statement of a partial analysis of Schuylkill Water, the sample having been taken on May 17th, from the laboratory hydrant. I am satisfied that the character of the water has not changed in any important particular since last month.

SCHUYLKILL WATER.

Chlorine	0·53
Nitrogen as Nitrates and Nitrites	0·0500
Free Ammonia	0·0014
Albuminoid Ammonia	0·0028
Sediment	Vegetable debris with siliceous matter.

In the report published in May number, the decimal points have been in two cases wrongly printed; the numbers should be, nitrogen as nitrates 0·0500 instead of 0·500 as printed; and oxygen consumed should be 0·0560 instead of 0·560 as given.

HENRY LEFFMAN, M.D.

920, *Walnut Street, Philadelphia, May 27th,* 1881.

Errata.—In the concluding portion of Mr. Heisch's Paper on the "Swedish Acts affecting Sale of Poisons" on page 101, four lines from the bottom, ·04 inch should be ·08; and on the same page, line 6 from top, the sentence should read—"It is remarkable that all Coal Tar Colours, if they contain arsenic, or other poisonous matters are mentioned, but, &c."

Errata.—"Instructions for Water Analysis," Reagents, p. 129, D. (*a*), 1000 parts, should be 10,000 parts.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York·Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Report on Sorghum and Cornstalks, Washington; Department of Agriculture.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

To ensure the completion of the analyses in time for the reports to be included in the monthly table, it has been thought desirable that these reports should in future comprise samples drawn between the 15th of one month and the 15th of the following month. Thus samples drawn between July 15th and August 15th should be considered as being the August supply. It will be very convenient if the analysts engaged will kindly forward their reports to the secretaries early in each month, and the arrangement now adopted will facilitate their doing so.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in June, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	June 12	p. grn. yelw. clr.	none	1·17	traces	·228	none	·0034	none	none	16·5°	5·0°	23·00	little vegetable debris	Wigner & Harland.
New River	„ 20	clear colourless	none	1·17	traces	·150	none	·0010	·0010	·0280	15·0°	4·8°	19·60	satisfactory	B. Dyer.
East London ..	„ 10	c. green yellow	slight	1·21	traces	·151	·0011	·0067	none	·0734	15·0°	3·6°	19·60	mineral mttr. veg. debris	Wigner & Harland.
Southwark & Vauxhall ..	„ 13	f. yellow & clear	none	1·12	trace	·180	none	·0067	·0022	·0605	14·5°	4·5°	19·88	satisfactory	J. Muter.
West Middlesex	„ 10	faint yellow	none	1·01	trace	·189	·0010	·0080	none	·0570	13·6°	3·7°	19 01	no deposit	O. Hehner.
Grand Junction		v. pale yellow	none	1·10	traces	·196	·0002	·0045	·0019	·0414	18·1°	3·6°	19·10	no deposit	A. Wynter-Blyth.
Lambeth	„ 18	f. yellow & clear	none	1·24	trace	·130	none	·0067	·0022	·0515	14·5°	4·5°	20·16	satisfactory	J. Muter.
Chelsea	„ 15	c. greenish yelw.	none	1·00	trace	·110	none	·0042	·0080	·0500	13·5°	3·0°	17·92		A. Dupré.
Bath	June 20	c. f. blue	none	·90	none	·012	none	·0005	none	none	17·0°	5·0°	22·5	no deposit	J. W. Gatchouse.
Birmingham ..	„ 7	s. turbid green.	none	1·19	traces	·185	·0020		·0056	·0189	9·73°	5·88°	18·17	vegetable matter	A. Hill.
Bradford	„ 15	s. yelw. transpt.	none	·65	none	none	·0010	·0068	·0260	·1500	3·7°	3·5°	6·80	no deposit	F. M. Rimmington.
Brighton	„ 8	p. yellow blue	slight	1·91	traces	·245	·0018	·0017	none	·0072	12·7°	8·5°	23·80	vegetable debris	Wigner & Harland.
Bristol	„ 13	pale green	none	1·13	trace	·054	·0007	·0035	·0014	·0070	15·0°	1·2°	25·80	sand, vegetable debris	F. W. Stoddart.
Cambridge	„ 8	c. pale blue	none	1·31	traces	·461	none	·0028	·0081	·0257	16·0°	4·0°	23·80	satisfactory	J. West-Knights.
Canterbury	„ 16	pale blue	none	1·47	none	·338	·0005	·0005	·0040	·0110	6·3°	5·7°	11·76	very slight mineral	S. Harvey.
Croydon	„ 10	bright colourless	none	1·19	trace	·379	none	·0040	none	·0420	15·5°	9·0°	23·2	vegetable fibre and sand	C. Heisch.
Darlington	„ 4	c. green	none	·68	trace	·025	trace	·0056	·0070	·1345	6·9°	4·5°	11·20	satisfactory	W. F. K. Stock.
Derby	„ 13	v. good	none	·95	trace	·115	·0007	none	trace	·0094	10·9°	4·9°	17·99	satisfactory	L. Archbutt.
Edinburgh	„ 17	c. colourless	none	0·83	none	trace	·0032	·0056	·0080	·0704	5·45°	4 20°	6·88	no sediment	J. Falconer King.
Exeter	„ 11	f. greenish yelw.	none	·84	trace	·193	·0035	·0014		·0490	2·8°	2·8°	6·30		F. P. Perkins.
Glasgow (Port)	„ 3	v. f. yellow	none	·79	trace		·0011	·0056	·0150	·1000	2·5°	2·5°	6·30	satisfactory	John W. Biggart.
Grantham	„ 16	c. greenish blue	none	1·05	trace	·696	·0022	·0028	none	·0272	13·6°	5·6°	21·67	few diatoms	A. Ashby.
Huddersfield ..	„ 14	yellowish green	none	·60	none	·025	none	·0035	none	·0061	2·0°	2·0°	4·50	peaty matter	G. Jarmain.
Hull	„ 20	good	none	1·32	traces	·240	·0030	·0019	·0030	·0040	15·3°	3·7°	23·00	satisfactory	J. Baynes, Jun.
Ipswich	„ 18	v. f. yellow	none	2·31	trace	·560	·0042	·0036	none	·0102	23·7°	4·2°	34 00	satisfactory	J. Napier.
King's Lynn*..	„ 3	decidedly turbid	dcdly. wdy.	1·66	h. traces	·2886	·0074	·0098	·0225	·2865	15·0°	4.3°	20·03		William Johnstone.
„	„ 5	decidedly turbid	dcdly. wdy.	1·38	h. traces	·6300	·0028	·0056	·0187	·3762	15·0°	4.2°	19·46		
„	„ 6	decidedly turbid	dcdly. wdy.	1·47	h. traces	·4200	·0028	·0084	·0200	·4375	15·1°	4.5°	19·74		
„	„ 7	decidedly turbid	dcdly. wdy.	1·68	h. traces	·3500	·0056	·00280	·0268	·4285	15·8°	4.8°	20 93		

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in June, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leamington ..	June 10	c. bright green.	none	1·40	none	none	·0014	·0028			23·6°	12·1°	28·70	none	A. Bostock Hill.
Leeds	„ 16	greenish yellow	none	·74	trace	none	none	·0039	·0112	·0868	3·4°	2·9°	4·76	none	T. Fairley.
Leicester......	„ 15	s. yellow	none	1·05	trace	·110	·0012	·0030	·0025	·0720	7·0°	4·70°	14·60	vegetable debris diatoms	W. L. Emmerson.
Liverpool	„ 15	greenish yellow	slight peaty	1·15	trace	·103	·0011	·0084	·0028	·0896	5·2°	5·1°	9·38	no deposit	A. Smetham.
Maidstone—															
Wtr. Company	„ 16	clear	none	2·90	trace	·115	none	·0031	·0098	·0112	16·6°	6·6°	35·17	none	M. A. Adams.
Public Conduit	„ 16	clear	none	2·60	trace	·115	none	·0013	·0098	·0089	17·3°	6·6°	34·30	none	M. A. Adams.
Manchester....	„ 17	c. colourless	none	·61	none	none	·0028	·0039	·0017	·0559	1·9°	1·9°	5·78	no deposit	W. Thomson.
Newcastle-on-Tyne......	„ 8	f. yellow	none	·88	trace	·046	·0010	.0090	·0060	·0960	12·9°	4·5°	16·00	satisfactory	J. Pattinson.
Norwich	„ 12	s. greenish yelw.	none	1·90	traces	·083	traces	·0060	·0340	·0830	13·1°	4·7°	21·60	satisfactory	W. G. Crook.
Nottingham ..	„ 13	c. bluish green	none	1·63	h. traces	·945	·0007	·0027	none	none	15·0°	8·5°	21·10	fibres veg. debris diatoms	Wigner & Harland.
Portsmouth ..	„ 14	clear	none	1·26	trace	·114	trace	·0026	none	none	14·0	2·1°	16·10	veg. deb. decayed diams.	W. J. Sykes.
Reading	„ 14	very clear	none	·90	none	·880	·0005	·0042	·0035	·0280	14·8°	3·9°	19·40	satisfactory	J. Shea.
Rochdale	„ 15	pale blue	none	·58	none	·014	·0014	·0026	·0028	·0300	1·80	1·60°	1·98	satisfactory	T. A. Collinge.
Rugby†	„ 2	turbid	none	1·26	h. traces	·008	·0010	·0105	·0137	·0687	16·6°	8·4°	28·00	veg. deb. anim. diatoms	A. P. Smith.
Salford	„ 17	cloudy yellow	none	·55	none	none	·0021	·0028	·0050	·0530	3·0°	2·5°	5·50	oxide of iron	J. Carter Bell.
Shrewsbury ..	„ 11	c. colourless	none	1·50	none	·250	·0010	·0020	none	none	19·0°	1·5°	25·00	none	T. P. Blunt.
Southampton..	„ 20	yellowish	none	1·05	h. traces	·539	·0025	·0086	·0080	·0800	12·5°	1·6°	19·60	vegetable debris	A. Angell.
Swansea	„ 17	clear	none	·90	trace	none	·0007	·0049	·0030	·0040	2·5°	2·5°	3·71	none	W. Morgan.
Whitehaven ..	„ 7	c. f. green	none	·37	traces	·015	none	·0011	none	·0116	·4°	·4°	1·83	mvg. orgms. veg. deb. &c.	A. Kitchin.
Wolverhampton	„ 13	yellowish tinge	none	1·33	h. traces	·051	·0003	·0098	·0027	·0826	12·6°	5·7°	20·30	very small chiefly diams.	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

* The samples drawn on 3rd and 5th represent the water after a continuance of very dry weather, and the other two samples were drawn after 12 and 36 hours continuous rain.

† This is filtered well water, and differs much in character from previous analyses, which were made on the surface water. In hot weather the surface supply fails, and the well is used.

LAW REPORTS.

Prosecution of a Medical Practitioner for selling Defective Chemical Food.—

On 19th April last, at Glasgow, Dr. James Downie was charged, before Sheriff Balfour, at the instance of the Local Authority, with a contravention of the Food and Drugs Act, by selling a bottle of chemical food which did not contain the requisite percentage of ingredients. The bottle was purchased on the forenoon of March 3rd last, at the drug shop at 1, Abercromby Street, by Mr. Robert Inglis, ordinary sanitary inspector, for purposes of analysis, and he paid 2s. for the bottle. It was supplied by a girl, who told Mr. Inglis that if he waited till six o'clock he might see Dr. Downie. On being analysed by the Public Analyst the drug was found to contain ·47 of a grain of phosphate of iron, and ·38 of a grain of phosphate of lime, whereas it should have contained 2¼ grains of phosphate of iron and 1 grain of phosphate of lime. For the defence it was contended that Dr. Downie, who had been in partnership with a medical student, had had nothing to do with the shop for the past eighteen months, but only used a room off the shop for the purpose of consulting with patients, although the business was carried on in Dr. Downie's name, and with his consent. The Sheriff found the charge proven, and imposed a fine of £3.

Gin Adulteration:—

Frank Dore, landlord of the Greycoat Boy, Roan Street, Greenwich, and Thomas Sadler, of the Rose and Crown, Thames Street, were summoned by the Greenwich District Board of Works for selling gin which was adulterated to the prejudice of the purchaser. Mr. Cordon, inspector to the Board, proved purchasing the gin and submitting it to the Public Analyst, who certified that Dore's was 41·5 and Sadler's 42 degrees under proof, but the admixture was not injurious to health. In defence, Dore said he told his barmaid to add 25 gallons of liquor to the 100, and she took a measure which held half-a-pint over the gallon. He had discharged her for the error. In the case of Sadler, Mr. Ruddle, solicitor, sought to prove that the strength of the gin had evaporated through being kept in a small vat in a room where there was a high temperature. He called a witness, who is employed at Holland's distillery, who said that gin would evaporate to the extent of 5 per cent. at least under such circumstances. The shifting would also cause evaporation. Mr. Marsham said a publican ought to see that the gin [was of proper strength when he sold it. The law made a very liberal allowance, which must not be exceeded. He fined Dore £2 and Sadler £2 10s.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
3898	C. Dickinson	Treating Sewage, &c.	2d.
4014	H. A. Bonneville	Preserving Animal and Vegetable Substances	4d.
4136	C. Barker	Separation of Zinc from other Metals	10d.
4191	G. P. Harding	Electric Lamps	6d.
4259	A. Gutensohn	Utilizing Phosphate of Alumina to obtain Phosphoric Acid	2d.
4274	C. Kesseler	Impregnating, &c., Water by Liquid Carbonic Acid	6d.
4292	D. S. Dawe	Manufacture of Portland Cement	2d.
4334	S. H. Johnson	Production of Saccharine Substances	1d.
4428	J. H. Johnson	Electric Lamps	4d.
4433	B. J. Mills	Converting Refuse and Infectious Animal Matters into Gas	8d.
4468	W. Black and T. Larkin	Furnaces for Calcining Carbonate of Soda	6d.
4511	J. Mactear	Furnaces for Chemical Processes	10d.
4514	W. F. Nast	Manufacture of Sugar from Cellulose or Ligneous Materials	4d.
4520	J. S. Stevenson	Apparatus for Distilling Ammoniacal Liquor	2d.
4522	J. Imray	Economising Nitrous Products in Manufacture of Sulphuric Acid	4d.
4541	W. A. Barlow	Purification of Alcohol	6d.
4614	C. W. Siemens	Electric Lamps	6d.
4651	W. S. Somers	Manufacture of Soap	2d.
4655	J. Chapman and G. B. Bates	Manufacture of Paints	2d.
4742	J. Bowing	Manufacture of Caustic Compounds	2d.
4745	J. E. H. Gordon	Electric Lamps	2d.
4773	H. J. Haddan	Manufacture of Diphenylamine of Aniline	2d.

THE ANALYSIS OF THE PUBLIC WATER SUPPLIES OF ENGLAND.*

INSTRUCTIONS FOR WATER ANALYSIS.

Prepared by a Committee appointed by the Society of Public Analysts.

WHEN the Society of Public Analysts arranged to publish monthly analyses made by its members of the water supplies of the leading towns in the kingdom, they contemplated the possibility of bringing about more general agreement than had formerly been practicable in the processes used, and the modes of reporting results. The scheme proposed has met with marked acceptance among analysts who, no doubt, in many cases may have reason to prefer other methods, but who have given way in favour of a system which appears to concern the general good of the profession, and to be for the public advantage.

This concord of opinion has already rendered it necessary to print a second edition of the instructions for water analysis, which were issued to the analysts engaged; and a third, but more detailed edition, is now called for. To answer the requirements of those who have been in correspondence with the Secretaries on the subject, this third edition contains such full and explicit details as will enable any competent analyst to execute a water analysis in such a way as to make the results *directly comparable* with those obtained by any other analyst working under these instructions.

The instructions do not take the form of an elementary treatise on water analysis, but they specify the essential details of the manipulation in such a way as to be intelligible to a skilled analyst.

The Water Committee of the Society has not been free from difficulty in the duty which it has undertaken, as it was only possible to adopt processes the details of which were such as could be carried out with ease and uniformity by the great body of analysts. On this account some matter in itself valuable has necessarily been omitted, such as the estimation of organic carbon and nitrogen, the instructions for more complete microscopical examinations, and Messrs. Crookes, Odling and Tidy's method for taking the colour of water.

The Committee has freely availed itself of published works and papers on water analysis, and has, as far as possible, tested every reported process, whether contained in the well-known treatises on the subject, or in the various papers contributed to their own and other Societies.

The method of reporting the results in grains per gallon has been adopted after very careful and mature consideration. The Committee are well aware that if reports were made in parts per 100,000, they would be equally intelligible to analysts generally, but they cannot overlook the fact that these reports have in many cases to pass into the hands of those to whom a statement in parts per 100,000 is more or less unintelligible. The instructions are worded in such a way that analysts can use either the English or the metric system of weights and measures for their own work, and can prepare their standard solutions according to either system, simply making their reports uniform by the adoption of the English figures. The tables of aliquot parts of a gallon, and factors, which are included in the instructions, will facilitate the necessary calculations.

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* It having been decided to publish the new edition of the Instructions for Water Analysis in THE ANALYST, we have arranged to page the monthly divisions so that the whole will bind up together when completed.

THE PREPARATION OF REAGENTS.

NOTE.—*All solids are to be weighed and liquids measured.*

A.—REAGENTS FOR THE ESTIMATION OF CHLORINE.

(*a*) *Standard Solution of Silver Nitrate*—

Dissolve 4·7887 parts of pure recrystallised silver nitrate in distilled water, and make the solution up to 1000 parts. The solution is to be standardized against the standard solution of sodium chloride, and adjusted if necessary: 1 c.c. = ·001 gramme of chlorine, or 10 grains = ·01 grain chlorine.

(*b*) *Standard Solution of Sodium Chloride*—

Dissolve 1·648 parts of pure dry sodium chloride in distilled water, and make the solution up to 1000 parts. 1 c.c. solution contains ·001 chlorine, or 10 grains contain ·01 grain chlorine. The pure sodium chloride is best prepared by taking a saturated solution of best commercial sodium chloride, filtering it cold, and passing a current of HCl. gas into it. The gas produces a fine crystalline precipitate of pure sodium chloride, which must be washed rapidly with cold water and dried at about 500° to 600° F.

(*c*) *Potassium Monochromate*—

50 parts of potassium monochromate are dissolved in 1000 parts of distilled water. A solution of silver nitrate is added until a permanent red precipitate is produced, which is allowed to settle.

B.—REAGENT FOR THE ESTIMATION OF PHOSPHORIC ACID.

Molybdic Solution—

One part pure molybdic acid is dissolved in 4 parts ammonia, sp. gr. ·960. This solution, after filtration, is poured with constant stirring into 15 parts of nitric acid of 1·20 sp. gr. It should be kept in the dark and carefully decanted from any precipitate which may form.

C. REAGENTS FOR THE ESTIMATION OF NITROGEN IN NITRATES.

(*a*) *Solution of Silver Sulphate*—

A saturated solution of silver sulphate in distilled water.

(*b*) *Concentrated Sulphuric Acid*—

In order to ensure freedom from oxides of nitrogen, this should be kept in a bottle containing mercury, and agitated from time to time, which will ensure their absence.

(*c*) *Metallic Aluminium*—

As thin foil.

(*d*) *Solution of Sodium Hydrate*—

Dissolve 100 parts of solid sodium hydrate in 1000 parts of distilled water. When cold, introduce a strip of about 100 square cms., say 15 square inches, of aluminium foil previously heated to just short of redness, wrapped round a glass rod. When the aluminium is dissolved, boil the solution briskly in a porcelain basin until about one-third of its volume has been evaporated, allow it to cool, and make it up to its original volume with water free from ammonia. The solution must be tested by a blank experiment to prove the absence of nitrates.

(*e*) *Broken Pumice*—

Clean pumice broken into pieces of the size of small peas, sifted free from dust, heated to redness, and kept in a closely stoppered bottle.

(f) Hydrochloric Acid free from Ammonia—

If the ordinary pure acid is not free from ammonia, it should be distilled. As only two or three drops are used in each experiment, it will be sufficient if that quantity does not contain an appreciable proportion of ammonia.

(g) Copper Sulphate Solution—

Dissolve 30 parts of pure copper sulphate in 1000 parts of distilled water.

(h) Metallic Zinc—

As thin foil. This should be kept in a dry atmosphere, so as to be preserved as far as possible from oxidation.

(i) Standard Solution of Ammonium Chloride—*(see* D *a).*

(k) Nessler's Solution— *(see* D *b).*

D.—Reagents for the Estimation of Nitrogen as Ammonia and Albuminoid Ammonia.

(a) Standard Solution of Ammonium Chloride.

Dissolve 3·146 parts of pure ammonium chloride in 1000 parts of distilled water free from ammonia. For use, dilute this with pure distilled water to ten times its bulk.

(b) Nessler Solution.

Dissolve 35 parts of potassium iodide in 100 parts of water. Dissolve 17 parts of mercuric chloride in 300 parts of water. The liquids may be heated to aid solution, but if so must be cooled. Add the latter solution to the former until a permanent precipitate is produced. Then dilute with a 20 per cent. solution of sodium hydrate to 1000 parts; add mercuric chloride solution until a permanent precipitate again forms; allow to stand till settled, and decant off the clear solution. The bulk should be kept in an accurately stoppered bottle, and a quantity transferred from time to time to a small bottle for use. The solution improves by keeping.

(c) Sodium Carbonate.

A 20 per cent. solution of recently ignited pure sodium carbonate.

(d) Potassium Permanganate Solution.

Dissolve 200 parts of potassium hydrate and 8 parts of pure potassium permanganate in 1100 parts of distilled water, and boil the solution rapidly till concentrated to 1000 parts.

(e) Distilled Water which is free from Ammonia.

Distilled water which gives no reaction with Nessler test is pure enough. But, if this is not available, take the purest distilled water procurable, add pure ignited sodium carbonate in the proportion of one part per 1000, and boil briskly until at least one-fourth has been evaporated.

E. Reagents for the Estimation of Oxygen Absorbed.

(a) Standard Solution of Potassium Permanganate—

Dissolve ·395 parts of pure potassium permanganate in 1000 of water. Each c.c. contains ·0001 gramme available oxygen, and each one grain contains ·0001 grain.

(b) Potassium Iodide Solution—

One part of the pure salt re-crystallized from alcohol, dissolved in 10 parts distilled water.

(c) Dilute Sulphuric Acid—

One part by volume of pure sulphuric acid is mixed with three parts by volume of distilled water, and solution of potassium permanganate dropped in until the whole retains a *very faint* pink tint, after warming to 80° F. for four hours.

(*d*) *Sodium Hyposulphite*—

One part of crystallized sodium hyposulphite dissolved in 1000 parts of water.

(*e*) *Starch Water*—

One part of starch to be intimately mixed with 500 parts of cold water, and the whole briskly boiled for five minutes, and filtered, or allowed to settle.

F. Reagents for the Estimation of Hardness.

(*a*) *Standard Solution of Calcium Chloride*—

Dissolve eight grains of pure crystallized calc spar in dilute hydrochloric acid in a platinum dish, adding the acid gradually, and taking precautions to prevent loss by spurting. When all is dissolved, evaporate to dryness in a water-bath, add a little distilled water and again evaporate to dryness. Repeat several times to ensure the expulsion of all the acid. Lastly, dissolve in water and make up to one-tenth of a gallon. For use: dilute to 10 times its volume, the result will be water of 8° of hardness. Or, instead of making the solution thus, dissolve 1·376 grains pure crystallized selenite in $\frac{1}{10}$th gall. water, and that will be the water of 8° of hardness.

(*b*) *Standard Soap Solution*—

Take 150 parts lead plaster (*Emplastrum Plumbi* P.B.), rub in a mortar with 40 parts dry potassium carbonate; when fairly mixed add absolute alcohol which has been standing over potassium carbonate for a few days. When solution is complete, filter and add sufficient recently boiled distilled water to reduce the alcohol to the strength of proof spirit. The solution of soap must then be reduced to the proper strength with proof spirit made by mixing recently boiled distilled water with the absolute alcohol prepared as directed above. It should be of such strength as just to form a permanent lather, when 180 grain measures are shaken with 1000 grains of a solution of lime of 8° hardness. The following table will then give the degrees of hardness corresponding to the number of grain measures employed:

Hardness.	Grain Measures.		Hardness.	Grain Measures.
0°	9	...	5°	120
1°	29	...	6°	140
2°	54	...	7°	160
3°	77	...	8°	180
4°	99	...		

After which 1 degree = 20 grain measures. This is the last solution recommended by Dr. Clarke, the one referred to in his patent not being quite accurate.

1. Collection of Samples.—All samples of water for analysis must be collected in stoppered glass bottles which have been cleaned by successive rinsings with acid and water. A Winchester quart will suffice. Stoneware bottles must not be used. Each bottle must be filled with the water to be sampled, and emptied, before the sample is taken for analysis. The bottle must then be filled to the neck, stoppered, and tied down.

Each report should specify the place where, and the date and time when, the sample was drawn. Wherever practicable, it is desirable to report the temperature of the water *at the time the sample was taken*, and also to observe whether the water when collected is clear or not. For an accurate analysis of a public water supply, it is essential that the sample should not be drawn from a cistern; a public stand-pipe, cab rank, or fire hydrant, is generally the most satisfactory place from which to take a sample; but, failing this, the ball-cock of a cistern is a permissible source. It is desirable to avoid drawing stagnant water from a pipe or dead main, and it is especially necessary to avoid ærating the water in the act of filling the bottle.

2. Appearance in 2-foot Tube.—The colour or tint of the water must be ascertained by examination in a tube 2 feet long and 2 inches in diameter. This tube should be made of glass as nearly colourless as may be, and should be covered at each end with a disc of perfectly colourless glass cemented on, an opening being left for filling and emptying the tube. This opening may be made either by cutting a small segment off the glass disc at one end or by cutting a small segmental section out of the tube itself before the disc is cemented on. These tubes are most conveniently kept on hooks in a horizontal position to prevent the entrance of dust.

The tube must be about half-filled with the water to be examined, brought into a horizontal position level with the eye, and directed towards a well illuminated white surface. The comparison of tint has to be made between the lower half of the tube containing the water under examination, and the upper half containing atmospheric air only.

3. Smell.—Put not less than 3 or 4 ounces of the water into a clean 8-ounce wide-mouth stoppered glass bottle which has been previously rinsed with the same water. Insert the stopper and warm the water in a water-bath to 100° F. (38° C.). Remove the bottle from the water-bath, rinse it outside with good water perfectly free from odour, and shake it rapidly for a few seconds; remove the stopper, and immediately observe if the water has any smell. Insert the stopper again and repeat this test.

When the water has a *distinct* odour of any known or recognized polluting matter, such as peat or sewage, it should be so described; when this is not the case, the smell must be reported simply as none, very slight, slight, or marked as the case may be.

4. Chlorine.—This is to be calculated as chlorine, and returned under the heading of "Chlorine in Chlorides."

Titrate at least 100 c.c. or 1,400 grains of the water with the standard silver nitrate solution, either in a white porcelain basin or in a glass vessel standing on a porcelain slab, using potassium chromate as an indicator. The titration is conducted as follows: The sample of water is measured into the basin or beaker, and 1 c.c. or 15 grains of potassium chromate solution added. The standard silver nitrate solution is then run in cautiously from a burette until the red colour of the precipitated chromate of silver, which is always observed at the point where the silver solution drops in, is no longer entirely discharged on stirring. The burette is then read off. It is best to repeat the experiment, as follows: Add a few drops of dilute sodium chloride solution to the water last titrated, which will discharge the red colour. Measure out a fresh portion of the water to be titrated into another basin and repeat the titration, keeping the first sample, the colour of which has been discharged, side by side with the second, so as to observe the first permanent indication of *difference* of colour. If the quantity of chlorine be so small that still greater accuracy is necessary, the titration may be conducted in the same way as last described, but instead of the operator looking directly at the water containing the chromate solution, he may place between the basin containing the water and his eye a flat glass cell containing some water tinted with the potassium chromate solution to the same tint as the water which is being tested, or may look through a glass coated with a gelatine film coloured with the same salt. Care must always be taken that the water is as nearly neutral as possible before titration. If originally acid it should be neutralized with precipitated carbonate of lime. If the proportion of chlorine be less than ·5 grain per gallon, it is desirable to take a larger quantity of the water, say 250 c.c. or 3,500 grains, for the estimation, and to concentrate this quantity on the water-bath before titrating it so as to bring it to about 100 c.c. or 1,400 grains. This titration may be performed by gaslight.

5. Phosphoric Acid.—This is to be returned under the heading of "Phosphoric Acid in Phosphates." The ignited total residue, obtained as hereafter directed, is to be treated with a few drops of nitric acid and the silica rendered insoluble by evaporation to dryness. The residue is then taken up with a few drops of dilute nitric acid, some water is added, and the solution is filtered through a filter previously washed with dilute nitric acid. The filtrate, which should measure 3 c.c. (or say 50 grains), is mixed with 3 c.c. of molybdic solution, gently warmed, and set aside for 15 minutes at a temperature of 80° F. The result is reported as "traces," "heavy traces," or "very heavy traces," when a colour, turbidity, or definite precipitate are respectively produced, after standing for 15 minutes.

6. Nitrogen in Nitrates.—This should be determined by one or other of the following processes, viz., *Crum, Copper-zinc or Aluminium.* Analysts should report which process is employed.

Crum Process.—This should be carried out in a Lunge's nitrometer as follows:—250 c.c. or 1/18th gallon of the water must be evaporated to a small bulk, the chlorine precipitated with solution of silver sulphate, filtered and concentrated in a basin to 2 c.c. or 30 grs. measure. A Lunge's nitrometer is charged with mercury, and the 3 way stop-cock closed, both to measuring tube and waste pipe. The concentrated filtrate is poured into the cup at the top of the measuring tube, and the vessel which contained it rinsed with 1 c.c. of water, and the contents added. The stop-cock is opened to the measuring tube, and, by lowering the pressure tube, the liquid is sucked out of the cup into the tube. The basin is again rinsed with 5 c.c. of pure strong sulphuric acid, and this is also transferred to the cup and sucked into the measuring tube. The stop-cock is once more closed, and 12 c.c. more sulphuric acid put into the cup, and the stop-cock opened to the measuring tube until 10 c.c. of acid have passed in. The excess of acid is discharged, and the cup and waste pipe rinsed with water. Any gas which has collected in the measuring tube is expelled by opening the stop-cock and raising the pressure tube, taking care no liquid escapes. The stop-cock is closed, the measuring tube taken from its clamp and shaken by bringing it slowly to a nearly horizontal position and then suddenly raising it to a vertical one. This shaking is continued until no more gas is given off, the operation being, as a rule, quite complete in fifteen minutes. Now prepare a mixture of 1 part of water with 5 parts of sulphuric acid, and let it stand to cool. After an hour, pour enough of this mixture into the pressure tube to equal the length of the column of acidulated water in the working tube, bring the two tubes side and side, raise or lower the pressure tube until the mercury is at the same level in both tubes, and read off the volume of the nitric oxide. This volume expressed in c.c.'s and corrected to normal temperature and pressure gives, when multiplied by ·175, the nitrogen in nitrates, in *grains per gallon,* if 250 c.c. of the water have been used. According to some authorities the precipitation of the chlorides is not necessary.

Copper-Zinc Process.—This must be carried out as follows:—A wet copper-zinc couple is prepared by taking a piece of clean zinc foil, about 3 in. by 2 in., and immersing it in a solution of copper sulphate, containing about 3 per cent. of the pure crystallized salt. A copious and firmly adherent coating of black copper is speedily deposited upon the surface of the zinc, which must be allowed to remain in the solution until the deposit is thick enough, but not for too long a time or it will become pulverulent and not adhere firmly to the zinc—three or four minutes will generally be sufficient.

The zinc coated with copper must then be removed from the solution, which may be bottled for subsequent use, and the couple thoroughly washed first with distilled water, and finally with the water to be analysed, in order that this may replace the adhering distilled water. It is then put into a clean 6 or 8-ounce wide-mouth stoppered glass bottle and covered with the water to be analysed, which may be 3 or 4 ounces or more in quantity. If the water be very soft a small addition, say one part per 1000, of sodium chloride, will accelerate the reaction. The stopper must then be inserted in the bottle and the water allowed to remain overnight in a warm place. If still greater speed be necessary the temperature may be raised to 90° or 100° F. (32° or 38° C.). With hard water it is preferable to add a small quantity of pure oxalic acid to precipitate the lime and quicken the reaction. On the following morning, the conversion of the nitrates into ammonia will be complete, and the proportion of ammonia formed must be estimated in one of the two following ways according to the character of the water.

If the water be sufficiently tinted to show a perceptible colour in the Nessler glass, or if it contains magnesium salts or other substances capable of being precipitated by the Nessler reagent, a measured portion of the sample after treatment with the copper-zinc couple must be distilled and the distillate nesslerized as hereafter described. If the water is not tinted, and does not contain any other substance that would interfere with the delicate action of the Nessler re-agent, it may be nesslerized direct. It will sometimes be necessary to dilute the water considerably before nesslerizing in order to enable the reading to be accurately taken. Ammonia found must be calculated to *nitrogen*, and not to ammonia, as in the nesslerizing of the ammonia distillates. The nitrogen, present as ammonia, must of course be deducted from the proportion found.

If any doubt exists as to the completion of the reaction, this may be ascertained by testing for nitrous acid, by adding a small quantity of a solution of metaphenylene diamine to a portion of the fluid acidified with sulphuric acid. A yellow colour will be produced in a few minutes if nitrous acid be present. If none be present the reaction is complete.

Aluminium Process.—This is carried out as follows:—50 c.c. or 1000 grains of the water are introduced into a retort, and 50 c.c. or 1000 grains of a 10 per cent. solution of caustic soda, free from nitrates added. If necessary, the contents of the retort should be distilled until the sample is free from ammonia. The retort is then cooled and a piece of aluminium foil introduced into it. The neck of the retort is inclined upwards and its mouth closed with a perforated cork, through which passes the narrow end of a small chloride of calcium tube filled with powdered pumice or glass beads wetted with very dilute hydrochloric acid free from ammonia. This tube is connected with a second tube containing pumice stone moistened with strong sulphuric acid, which serves to prevent any ammonia from the air entering the apparatus, which is allowed to stand in this way for a few hours or overnight. The contents of the first absorption tube—that next the retort—are washed into the retort with a little distilled water free from ammonia, and the retort adapted to a condenser. The contents of the retort are distilled to about half their original volume. The distillate is collected and an aliquot part nesslerized; and, if necessary, the rest of the distillate is diluted, and an aliquot part again nesslerized as hereafter directed.

7. Ammonia Free and Albuminoid.—The estimation of ammonia present in the water in a free or saline form, and of that yielded by the nitrogenous matter present in the water (commonly called albuminoid ammonia), is to be made on the same portion of the sample to be analysed.

Take not less than 500 c.c. or 7000 grains (one deci-gallon) of the water for these determinations, and distil in a 40 oz. stoppered retort, as this is large enough to prevent the probability of portions of the water being spurted over into the condenser. The neck of the retort should be small enough to pass three or four inches into the internal glass tube of a Liebig's. condenser. If the fit between the retort and the inside tube of the condenser is good, the joint may be made by wrapping a small piece of washed tinfoil round the retort tube so as to pass just inside the mouth of the condenser tube. Many analysts prefer, however, to work with a retort fitting loosely into the condenser; and in such cases the joint between the two may be made in one of the two following ways:—1st. either by an ordinary indiarubber ring—such as those used for the tops of umbrellas—which has been previously soaked in a dilute solution of soda or potash—being stretched over the retort tube in such a position that when the retort tube is inserted in the condenser it shall fit fairly tightly within the mouth of the tube about half an inch from the end; 2nd, preferably, when the shape of the large end of the condenser admits of it, by a short length, say not more than two inches, of large size indiarubber tubing, which has been previously soaked in a dilute solution of soda or potash, being stretched outside both retort tube and condenser tube, so as to couple them together, so that the tube of the retort still projects some inches into that of the condenser. It is very desirable to have a constant stream of water round the condenser whenever it can be obtained. Before distillation a portion of the water must be tested with cochineal in order to ascertain if it shows an alkaline reaction. The portion so tested must, of course, be rejected and not put into the retort. If the water does not show an alkaline reaction, a sufficient quantity of ignited sodium carbonate, to render the water distinctly alkaline, must be added. The distillation should then be commenced, and not less than 100 c.c., or, say, 1400 grains, distilled over. The receiver should fit closely, but not air-tight, on to the condenser. The distillation should be conducted as rapidly as is compatible with a certainty that no spurting takes place. After 100 c.c., or, say, 1400 grains, have been distilled over, the receiver should be changed, that containing the distillate being stoppered to preserve it from access of ammoniacal fumes. 100 c.c. measuring flasks make convenient receivers. The distillation must be continued until 50 c.c., or, say, 700 grains, more are distilled over; and this second portion of the distillate must be tested with Nessler's reagent to ascertain if it contains any ammonia. If it does not, the distillation for free ammonia may be discontinued, and this last distillate rejected; but, if it does contain any, the distillation must be continued still longer, until a portion of 50 c.c., or, say, 700 grains, when collected, shows no colouration with the Nessler test. The whole of the distillates must be nesslerized as follows:—The standard solution for comparison must be such that it contains ·317 parts per ten thousand of chloride of ammonium (= one part of ammonia in 100,000). The distillate is transferred to a clean Nessler glass, and one-twentieth of its volume of Nessler solution added. The Nessler solution must be clear and of a pale straw tint, when seen in an 8-oz. bottle. No turbidity must ensue on the addition of the Nessler solution to the water, as such turbidity would be a proof that the distillate was contaminated, and must, therefore, be rejected, and the determination repeated.

After thoroughly mixing the water and Nessler solution in the glass, an approximate estimate can be formed of the amount of ammonia present by the amount of colouration produced in the solution. It will now be necessary to mix one or more standard solutions with which to compare the tint thus obtained. These solutions must be made by mixing the standard solution of chloride of ammonium with distilled water absolutely free from ammonia, and subsequently adding some of the same Nessler solution as was previously added to the distillate. This precaution is essential, because the tint given by different samples of Nessler solution varies. A colorimeter may be used, if preferred, instead of Nessler glasses.

As soon as the distillation of the free ammonia has been started, the alkaline solution of permanganate of potash should be measured out into a flask ready for addition to the water under examination for the distillation of the albuminoid ammonia. The volume of the alkaline permanganate solution to be taken must be at least one-tenth of that of the water which is being distilled, and should not exceed that proportion unless the water is of very bad quality, and the solution must be made in accordance with the directions contained in these instructions. This solution must be diluted with four times its own volume of water, and must be placed in a flask and boiled during the whole time that the distillation of the sample for free ammonia is being carried on, care being taken that the concentration does not proceed to too great an extent. There must be enough of this boiled and diluted alkaline permanganate solution to make up the residue in the retort to about 500 c.c. or 7000 grains. When the distillation of the sample of water for free and saline ammonia is completed, the alkaline permanganate solution which has been thus diluted and boiled will be ready for use, and the distillation for albuminoid ammonia may be proceeded with as follows:—

To the residue left in the retort from which the free ammonia has been distilled, add the alkaline permanganate solution to make it up again to a volume of at least 500 c.c., or say 7000 grains, and the lamp being replaced, the distillation must be continued, and successive portions of the distillate again collected in precisely the same way as during the process of distillation for free ammonia.

After 200 c.c. or 3000 grains, say two-fifths of the volume contained in the retort have been distilled over, the receiver should be changed, and further portions of 50 c.c., or 700 grains, collected separately, until the distillate is practically free from ammonia. The distillates must then be mixed, and nesslerized in the same way as previously directed for free ammonia. The result so obtained must be calculated to ammonia in grains per gallon, and returned as albuminoid ammonia.

Special care must be taken that the atmosphere of the room in which these distillations are performed is kept free from ammoniacal vapours, and that the receivers fit close, but not airtight, to the end of the Liebig's condenser. It is also specially necessary to observe that the colour of the distillate deepens gradually after the addition of the Nessler re-agent, and that it is not possible to read off the amount of colour correctly until the nesslerized liquor has stood for at least three minutes, and been intimately mixed with the Nessler solution.

Special care must be taken that the retort, condensers, receivers, funnels, Nessler glasses, &c., used are all rendered perfectly free from ammonia before use. Where the water in use in the laboratory is good, this may be used to thoroughly rinse the apparatus two or three times, draining out the adhering water; otherwise pure distilled water must be used. These ammonia and albuminoid ammonia determinations should be made as soon as possible after the water has been received for analysis.

8. OXYGEN ABSORBED.—Two separate determinations have to be made, viz., the amount of oxygen absorbed during 15 minutes, and that absorbed during four hours; both are to be made at a temperature of 80° F. It is most convenient to make these determinations in 12-oz. stoppered bottles, which have been rinsed with sulphuric acid and then with water. Put 250 c.c. or 3,500 grains into each bottle, which must be stoppered and immersed in a water-bath or suitable air-bath until the temperature rises to 80° F. Now add to each bottle 10 c.c. or 100 grains of the dilute sulphuric acid, and then 10 c.c. or 100 grains of the standard potassium permanganate solution. Fifteen minutes after the addition of the potassium permanganate, one of the bottles must be removed from the bath and two or three drops of the solution of potassium iodide added to remove the pink colour. After thorough admixture, run from a burette the standard solution of sodium hyposulphite, until the yellow colour is nearly destroyed, then add a few drops of starch water, and continue the addition of the hyposulphite until the blue colour is just discharged. If the titration has been properly conducted, the addition of one drop of potassium permanganate solution will restore the blue colour. At the end of four hours remove the other bottle, add potassium iodide, and titrate with sodium hyposulphite as just described. Should the pink colour of the water in the bottle diminish rapidly during the four hours, further measured quantities of the standard solution of potassium permanganate must be added from time to time so as to keep it markedly pink.

The hyposulphite solution must be standardized, not only at first, but (since it is liable to change) from time to time in the following way:—To 250 c.c. or 3500 grains of pure redistilled water add two or three drops of the solution of potassium iodide, and then 10 c.c. or 100 grains of the standardized solution of potassium permanganate. Titrate with the hyposulphite solution as above described. The quantity used will be the amount of hyposulphite solution corresponding to 10 c.c. or 100 grains as may be of the standardized potassium permanganate solution, and the factor so found must be used in calculating the results of the hyposulphite titrations to show the amount of the standard permanganate solution used, and thence the amount of oxygen absorbed.

The difference between the quantity of hyposulphite used in the blank experiment and that used in the titration of the samples of water multiplied by the amount of available oxygen contained in the permanganate added, and the product divided by the volume of hyposulphite corresponding to the latter is equal to the amount of oxygen absorbed by the water.

9. HARDNESS BEFORE AND AFTER BOILING.—Place 100 c.c. or 1000 grains of the water in an accurately stoppered 8 oz. bottle. Run in the soap solution from a burette in small quantities at a time. If the water be soft not more than 1 c.c. or 10 grains at a time, if hard, in larger quantities at first. After each addition, shake the bottle vigorously for about a quarter of a minute. As soon as a lather is produced, lay the bottle on its side after each addition, and observe if the lather remains permanent for five minutes. To ascertain this, at the end of five minutes, roll the bottle half-way round; if the lather breaks instead of covering the whole surface of the water, it is not permanent; if it still covers the whole surface, it is permanent: now read the burette.

Repeat the experiment, adding the full quantity of soap solution employed in the first experiment, less about 2 c.c. or 20 grains; shake as before, add soap solution very gradually till the permanent lather is formed: read the burette, and take out the corresponding hardness from the table. If magnesian salts are present in the water the character of the lather will be very much modified, and a kind of scum (simulating a lather) will be seen in the water before the reaction is completed. The character of this scum must be carefully watched and the soap test added more carefully, with an increased amount of shaking between each addition. With this precaution it will be comparatively easy to distinguish the point when the false lather due to the magnesian salts ceases, and the true persistent lather is produced.

If the water is of more than 16° of hardness, mix 50 c.c. or 500 grains of the sample with an equal volume of recently boiled distilled water which has been cooled in a closed vessel, and make the determination on this mixture of the sample and distilled water. In this case it will of course be necessary to multiply the figures obtained from the table by 2.

To determine the hardness after boiling, boil a measured quantity of the water in a flask briskly for half-an-hour, adding distilled water from time to time to make up for loss by evaporation. It is not desirable to boil the water under a vertical condenser, as the dissolved carbonic acid is not so freely liberated. At the end of half-an-hour, allow the water to cool, the mouth of the flask being closed; make the water up to its original volume with recently boiled distilled water, and, if possible, decant the quantity necessary for testing. If this cannot be done quite clear, it must be filtered. Conduct the test in the same manner as described above.

The hardness is to be returned in each case to the nearest half degree.

10. Total Solid Matters.—Evaporate 250 c.c., or, say, $\frac{1}{18}$th gallon, in a weighed platinum dish on a water-bath, dry the residue at 220° F., and cool under a dessicator; weigh the dish containing the residue accurately, and note its colour and appearance and especially whether it rapidly increases in weight; return to the water-bath for half-an-hour and reweigh until it ceases to lose weight, then gradually heat it to redness, and note the changes which take place during this ignition. Especially among these changes should be observed the smell, scintillation, change of colour, separation of more or less carbon, and partial fusion, if any. The ignited residue is to be used for the estimation of phosphoric acid as before directed.

11. Microscopical Examination of Deposit.—The most convenient plan of collecting the deposit is to place a circular microscopical covering glass at the bottom of a large conical glass holding about 20 ozs. The glass should have no spout, and should be ground smooth on the top. After shaking up the sample, this vessel is filled with the water covered with a plate of ground glass and set aside to settle. After settling, the supernatant water is drawn off by a fine syphon, and the glass bearing the deposit lifted out, either by means of a platinum wire, which should have been previously passed under it, or in some other convenient way, and inverted on to an ordinary microscopical slide for examination. It is desirable to examine the deposit first by a $\frac{1}{5}$th and then by a $\frac{1}{8}$th objective. The examination should be made as soon as the water has stood overnight. If the water be allowed to stand longer, organisms peculiar to stagnant water may be developed and mislead the observer. Particular notice should be taken of bacteria, infusoria, ciliata or flagellata, disintegrated fibres of cotton, or linen, or epithelial debris.

It is particularly desirable to report clearly on this microscopical examination, not merely giving the general fact that organisms were present, but stating as specifically as possible, the names or classes of the organisms, so that more data may be obtained for the application of the examination of this deposit to the characters of potable waters.

It is also desirable to examine the residue left on a glass slide by the evaporation of a single drop of the water. This residue is generally most conveniently examined without a covering glass. The special appearances to be noticed are the presence or absence of particles of organic matter, or organised structure, contained in the crystallized forms which may be seen, and also whether any part of the residue left, especially at the edges, is tinted more or less with green, brown, or yellow.

In connection with the microscopical examination it will also be desirable to adopt the sugar process, described by Mr. Heisch, as follows:—

12. Sugar Test.—The name of this process relates simply to the reagent which is used, namely, pure crystallized sugar. It is believed to be a test for the presence of the germs or spores of the sewage fungus. This special form of fungus grows very rapidly in water containing even a small admixture of sewage water, especially if sugar be present. It grows as well in a closed bottle of the liquid being tested, as in water exposed to the air, and even better in an atmosphere of carbonic acid.

To apply the test: Take a 5-ounce stoppered bottle which has been thoroughly cleaned and rinsed with the water to be tested. Fill with the water to be examined, add about 10 grains or say ·5 grammes of crystals of pure sugar, insert the stopper, and put the bottle in a good light, keep it at a temperature of as nearly as possible 80° F. The water should be free from suspended matters before the experiment is made.

The bottle must be carefully examined after two or three hours, and again if necessary at intervals. The fungus appears first in the form of minute floating white specks which are generally easily visible to the naked eye in a good side light when the bottle is looked at against a black background. A pocket lens may sometimes be used with advantage.

If any suspected speck is seen it must be caught by a fine pipette and transferred to a glass slide, covered, and examined with a ¼ objective and B eyepiece.

When first seen, these specks are found to consist of small isolated cells with a bright nucleus. In the second stage the form resembles a bunch of grapes. The bright nucleus is still seen. This second stage generally takes not more than four to six hours for full development. A few hours after the second stage has become clear, the cells assume the form of moniliform threads. After this they assume the form of ordinary mycelium, with sparsely diffused cells. Finally the cells disappear and leave only ordinary mycelium.

When the proportion of sewage is large, it is often accompanied by a distinct smell of butyric acid.

A few experiments on mixtures of small proportions of sewage matter with water will give sufficient data to enable this peculiar fungus to be readily recognised.

The following is the form in which the analysis should be reported:—

Grains per gallon.

Description of sample.
Drawn.
Temperature when drawn.
Appearance in two foot tube.
Smell when heated to 100° F.
Chlorine in Chlorides.
Phosphoric Acid in Phosphates.
Nitrogen in Nitrates.
Ammonia.
Albuminoid Ammonia.
Oxygen absorbed in 15 minutes at 80° F.
,, ,, 4 hours ,,
Hardness before boiling (Clark's scale).
,, after ,, ,,
Total solid matter dried at 212° F.
Microscopical examination of deposit.
Remarks.

THE ANALYST.

AUGUST, 1881.

SOCIETY OF PUBLIC ANALYSTS.

An Extraordinary General Meeting was held at Burlington House on the 27th June; the President, Mr. Heisch, in the chair, for the purpose of considering the desirability of giving power to the Council to *nominate* Foreign Members for election by ballot. It was proposed by Mr. Wigner, Secretary, seconded by Mr. Lyte, Secretary, that the following be inserted in the Rules of the Society at page 2, line 5 from top, after "personal knowledge":

"Except in the case of any candidate not residing in Great Britain or Ireland, in which case a majority of two-thirds of the Council present at any meeting may *recommend* the candidate to the Society for election."

The motion was put to the meeting and carried unanimously.

A Special Meeting was then held.

The minutes of the meeting held on 1st June were read and confirmed.

The following gentlemen were proposed as members, and will be ballotted for at the country meeting:—Mr. C. Girard, Public Analyst for Paris, and Mr. C. T. Kingzett, Analytical Chemist, F.C.S., F.I.C.

Mr. Heisch read a further paper "On the Swedish Laws for the Sale of Poisons."

Dr. Wallace sent for inspection by the members of the Society a Certificate by the Government Chemist at Stockholm, of a test for Arsenic in a carpet, together with the tube containing the result of the test, and a piece of the carpet. This certificate had been translated, and a copy of the translation will be found on another page.

The following papers were also read: "On the Figures or Patterns which Drops of various Fats assume under certain Conditions," by A. Wynter-Blyth, M.R.C.S.

"On the Estimation of Quinine in Wines, Tinctures, &c.," by A. Wynter-Blyth, M.R.C.S.

"On a Modification of Wynter-Blyth's Apparatus for Digestions in Ether, as applied to Milk Analysis," by W. F. K. Stock, F.C.S., F.I.C.

"On a New Burner for Griffin's Gas Muffle Furnace," by W. F. K. Stock, F.C.S., F.I.C.

"Note on the Determination of Nitrogen as Nitrates," by S. Harvey, F.C.S.

"On the Detection of Lead in Waters by Potassium Bichromate," by S. Harvey, F.C.S.

NOTE ON THE ISOLATION OF STRYCHNINE.

By Alfred H. Allen.

Read before the Society of Public Analysts, on 11th March, 1881.

Chemists who are in the habit of employing ether and chloroform for the separation of alkaloids and other active principles from aqueous liquids, will have noticed a marked difference in their behaviour. In the case of ether, the layer of solvent either separates in a few seconds from the aqueous liquid, or can be induced to do so with absolute certainty by adding more ether or by thoroughly cooling the liquid. I have never met with an instance in which ether refused to separate very rapidly, provided that it was used in such quantity that the etherial layer fully equalled in bulk the lower aqueous stratum.

The behaviour of chloroform exhibits a great contrast with that of ether; frequently many hours, and occasionally days, being requisite for its separation from the aqueous layer, and for the coalescence of the chloroform globules. Even then it not unfrequently has a milky appearance, which is rarely if ever noticed in the case of ether.

Some operators by preference employ chloroform rather than ether in cases where either liquid is equally suitable, as it is in the isolation of quinine. This preference is probably generally due to the supposed advantage obtained by the greater density of chloroform, which causes its collection below instead of at the surface of the aqueous layer. In certain other cases, however, there is the far stronger reason that chloroform is a greatly superior solvent for the substance to be extracted. Strychnine forms a notable instance of this, being variously stated to require from 340 to 1800 parts of ether, but only 7 to 10 parts of chloroform for solution. Nevertheless, and doubtless in consequence of the trouble and delay in the separation of a chloroformic layer, Dr. Tidy and other eminent toxicologists recommend the use of ether instead of chloroform for the isolation of strychnine.

I have myself, till lately, been in the habit of employing ether for the same reason, but now use a solvent which unites a high solvent power for strychnine with the property of ready separation from the aqueous liquid. This consists of a mixture of equal volumes of chloroform and ether. Such a mixture has a density of about 1·10, and hence is sensibly heavier than most aqueous liquids. I have however, recently employed it with solutions so largely loaded with sugar that the solvent mixture floated on the surface; nevertheless, the separation occurred with great facility. In cases where the aqueous liquid approximates very closely in gravity to the solvent, separation can be readily induced by adding water (or better, ammonia). Of course, an additional quantity of chloroform or ether may also be added, but if the former be employed in notable excess the facility of separation is apt to be materially impaired, whilst if ether be added in considerable quantity the solvent power of the mixture for strychnine is materially reduced. That this last objection, however, has no great weight is proved by the following results of experiments made by my pupil, Mr. Charles Harrison, to test the point.

One gramme of commercial strychnine was dissolved in acidulated water, and the solution diluted to 100 c.c.

Experiment I.—10 c.c. measure of the above solution (= ·100 gramme strychnine) was treated with excess of ammonia, and the liquid agitated with 10 c.c. of a mixture of equal bulks of chloroform and ether. On drawing off and evaporating the solvent, exactly ·100 gramme residue was obtained. On again agitating the alkaline liquid with ether-chloroform, an additional weight of ·004 gramme was extracted.

Experiment II.—A repetition of the above experiment gave ·087 gramme by the first extraction, and an additional ·019 gramme on re-agitating, thus making a total of ·106 gramme dissolved.

These experiments sufficiently prove that the solubility of recently precipitated strychnine in ether-chloroform is amply sufficient to ensure its solution in practice. It will be observed that the weights of the total residues obtained somewhat *exceeded* the original weights of the alkaloid employed. This fact is doubtless due to the strychnine as dried for a short time at 100° C., retaining some water of combination. I propose to examine this matter more fully. It was found that when the solution of the strychnine in ether-chloroform approached dryness, it was exceedingly apt to decrepitate, thus occasioning loss of alkaloid. This tendency was avoided by adding a few drops of alcohol towards the close of the evaporation. This precaution is only necessary when perfectly pure strychnine is in solution. The small quantity of impurity usually extracted along with the strychnine when the method is used in toxicological investigations, appears to prevent the tendency to decrepitation. In the extraction of strychnine in such practice, I find it convenient to bring the acidulated aqueous liquid to a volume of about 20 c.c., agitate it with ether-chloroform to remove piperine, glucosides, &c., separate, render the liquid strongly alkaline with ammonia, and at once agitate with 30 c.c. of ether-chloroform. The separation usually occurs very rapidly, but may be induced with certainty by adding water or ether in the manner already described.

ON THE SWEDISH LAWS FOR THE SALE OF POISONS.

By C. Heisch, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 27th June, 1881.

You will remember that when I brought before you an abstract of the Swedish decrees on the sale of poisons, I drew your attention to the fact that, though the production of a brown or black arsenical mirror in a tube of 2 m.m. diameter, from 50 Swedish square inches of paper hangings, or 25 of textile fabrics was said to be enough to prohibit the sale of such goods, no hint was given as to the process by which such mirror was to be produced, nor of the quantity of arsenic it was supposed to represent. Since that time I have endeavoured to determine what is the smallest quantity of arsenic which will produce such a mirror, and as no process was mentioned, I used what I thought the best, the modification of Marsh's test, in which the arseniuretted hydrogen is passed through a red hot tube, and the arsenical mirror produced in the tube just beyond the red hot portion. I place before you three tubes. No. 1, diameter ¼-inch, contains arsenic from ·001 gr. AS_2O_3. No. 2, ¼-inch diameter, arsenic from ·00116 AS_2O_5, the same amount of arsenic as No. 1. No. 3, one-tenth inch diameter, the same amount of arsenic. Even this last is one-fifth larger than the Swedish tube, yet the arsenical mirror is absolutely opaque. How much farther one could go I cannot quite say, but half the above quantity gives not only a perceptible mirror, but when sublimed on to a micro-slide a good crop of octahædral crystal of AS_2O_3. The only difference I can find in the results from AS_2O_3 and AS_2O_5 is that while ·001 AS_2O_3 is all reduced and deposited in half-an-hour, ·001 AS_2O_5 takes over two hours for complete reduction. Professor Sell, of Stockholm, when asked what process was intended by the decree of November, 1879, replied that he could not say any particular process was ordained, but he should treat the sample with either H_2SO_3, or fuming nitric acid, wash and precipitate with H_2S, and reduce with NA_2CO_3 and KCy. This would certainly not give such good results with small quantities as the Marsh test, and take much more time and trouble.

A few days since we received from Dr. Wallace, of Glasgow, for exhibition to-night, a sample of carpet which had been condemned by the analyst in Stockholm, with the certificate and tube of arsenic attached, as directed by the act. A translation of this certificate I place before you, the parts in ordinary type being the official printing, those in italics the filling in for this particular article. On the certificate is the description of the process employed, which is much that contained in Professor Sell's letter, but more detailed. Dr. Wallace also gives us the process as described to him by the owner of the carpet, which is the same as that on the certificate, with this addition, that the fact of the mirror being enough to condemn the carpet was judged by observing if a black line on a white ground could be seen through it: if it could not the sale of the article was prohibited I may mention that according to the best evidence we have been able to obtain, no injurious effects have yet been traced to a paper hanging containing as little as ·5 grains per piece of nine square yards, but beyond this it is not safe to go. This would correspond to ·001 grain in 16 square inches, and from that quantity we can, as you see, obtain an opaque mirror. In Sweden 50 Swedish square inches or 68 English are employed, and an opaque mirror condemns the article. If, however, the process mentioned on the certificate shown be universally employed, probably much larger quantities would be required to produce the same mirror as we obtain by Marsh from ·001 grain. Dr. Wallace mentions that he cannot obtain satisfactory results by following the Swedish method, at which I think no one will be surprised. You will observe that on the certificate the fee, 3-50 is mentioned as the official one. This means 3 krona 50 ore, or 3 krona and a-half, the value of the krona is 1/1, so the fee is 3/9½. This beats our adulteration fee hollow, but I suppose money goes farther in Stockholm.

BUREAU OF TECHNICAL CHEMISTRY, STOCKHOLM,
40, DROTTINJGATTEN (QUEEN STREET), 40.

At the Bureau of Technical Chemistry was left on *the 8th instant by Messrs. H. I. Heymann & Co., of Gothenburg, a sample of so called tapestry carpet of various colours, the remainder of which is attached hereto.*

To be examined for the presence of arsenic.

The result of the Chemical Analysis was as follows:—

Size of piece operated on *25 square inches.*

That according to the present poison regulations, the trade in the same is forbidden.

The glass tube attached hereto is that in which the arsenical mirror was received.

The examination was carried out by breaking up the sample with fuming nitric acid and washing the mass with water, precipitating the heavy metals with sulphuretted hydrogen after concentration. Treating the precipitated sulphides with caustic ammonia, evaporating the solution so obtained to dryness, and reducing the residue with soda and cyanide of potassium in a stream of carbonic acid on the Von Babo-Fresenius method. All the reagents used have been found by me free from arsenic, which I hereby declare.

Trades Chemist in Stockholm,
A. WERNER CRONQUIST.

Reference No. *7521.*
Analysis No. *30,170.*
Fee according to prescribed tariff, *3-50.*

The following is the mode of testing for arsenic in textile fabrics, &c., by the Swedish

Government Analyst, as ascertained by a carpet manufacturer who recently visited Stockholm, and forwarded to the Society, together with the original certificate, by Dr. Wallace.

The sample is dissolved by means of fuming nitric acid and the result (after evaporation) washed (dissolved) in water; the heavy metals are precipitated by sulphuretted hydrogen, and the sulphides obtained are treated with ammonia, and the solution thus obtained is evaporated to dryness and reduced by means of soda (carbonate) and cyanide of potassium in a stream of carbonic acid gas.

The arsenic is reduced to the metallic state in a glass tube, the diameter of which must not exceed 2 millimetres.

220 square centimetres are operated upon, equal to 25 square inches Swedish, or 34 square inches English. If the glass (tube) is not transparent, so that a black line on white ground (such as a black line on writing paper) may not be seen through it, the goods are prohibited. The carpet in question contained about half a millegramme in 220 square c.m., or say about 1-20th of a grain in a square foot (Swedish).

ON A MODIFICATION OF WYNTER-BLYTH'S APPARATUS FOR DIGESTIONS IN ETHER AS APPLIED TO MILK ANALYSIS.

By W. F. K. Stock, F.C.S., F.I.C.

Read before the Society of Public Analysts on 27th June, 1881.

Owing to the rapid diffusion of heat through cast iron, and the difficulty found in retarding this diffusion when working with thin sections, coupled with the obvious difficulty of applying Wynter-Blyth's original apparatus to the use of platinum basins of conveniently small size, I have adopted the following simple modification. The concave iron vessel is replaced by a flat iron casting, which may be either rectangular or circular. This plate is one inch thick by six inches square or diameter. In one side a half-inch groove is *turned*, not cast, to form a seat for the welted edge of a narrow tubulated bell jar, convenient dimensions for which are 7 inches high by 4½ inches diameter, ¾ inch tubulure. This bell-jar is fitted with a long, light, Liebig's Condenser, having a water jacket 20 inches long by 1 inch diameter, with an inner tube of ¼ inch bore.

The clearest conception of the use of this apparatus will perhaps be gained if I describe a fat determination by my present method.

10 grms. or so of milk are evaporated in a platinum basin 2¼ inches wide by ¾-inch deep. This is done on the water-bath, and requires about an hour and a quarter. The basin and residue is placed in a 10-ounce beaker, 60 c.c. of dry ether are poured over it, and the beaker is of such a size that the ether covers the basin to the depth of nearly half-an-inch. The beaker and contents is placed within the groove on the cast iron plate, the bell-jar with condenser attached is turned over it, sufficient mercury is run into the groove to give a perfect seal, a stream of water is sent through condenser, and the whole is best left for a night. In the morning a low gas jet is placed under the plate, which stands on a strong tripod, and the ether is allowed to boil gently for an hour or more. A weighed beaker having been got ready, the gas is turned out, bell-jar removed, and the ether carefully decanted into the weighed beaker, the basin being first lifted and drained by

means of a pair of bright brass tongs. This is repeated three times, boiling for fifteen minutes each time. The remaining operations require no description. In practice I have three of these arrangements standing on one bench, and the same stream of water feeds them all. Of course they must be well apart for fear of accidental ignition of the vapour of the ether.

There is an advantage in having the beaker to contain the basin, which is not at first seen, but anyone using this apparatus would soon discover it. It is that the ether in the beaker boils more rapidly than that in the basin, and the point of the condensing tube being ground off obliquely and directed to the centre of the platinum basin, there is a constant wash of pure dry ether, which rapidly displaces the contents of the basin, and tends largely to the proper and perfect solution of the fat.

The following trials have been made with the apparatus.

60 c.c. ether have been *boiled* for three hours continuously. Loss = 10 c.c. This was in winter.

Check Fats on milk gave:—

	No. 1.	No. 2.	No. 3.
Fat =	2·61	2·61	2·61

Another sample analysed by two operators at a distance. Methods unknown to each other.

	Wynter-Blyth modified.	Unknown.
Fat =	2·48	2·51

Difference: ·03 per cent.

For the information of analysts disposed to try the modification, I may just add that the plates cost 4/0 each with groove turned out, bell jars 1/6 each, indiarubber corks for condenser, 6d. Tripods and condensers were made at home in my case, the latter being got out of old water analysis condensers.

NOTE.—I tried on several occasions to recover the ether, but I rapidly came to the conclusion that the loss of the solvent was the truest economy.

In the discussion which ensued, Mr. Wynter-Blyth said that he had never proposed his apparatus for milk, he rather proposed it as a useful thing in the laboratory; he himself used Soxhlett's milk apparatus now. He found his own apparatus very useful for miscellaneous purposes; he used it for the recovery of ether more than anything else, especially when the ether was in small flasks, and could be put into this apparatus without any cork and distilled over.

ON THE DETECTION OF LEAD IN POTABLE WATERS BY MEANS OF POTASSIUM BICHROMATE.

By Sidney Harvey.

Read before the Society of Public Analysts, on 27th June, 1881.

THE dark color struck by hydrogen sulphide in samples of water suspected of metallic impregnation may be due to lead, copper, tin, and possibly other metals, and as the tone and intensity of tint produced by this re-agent varies in the case of the three metals above named, it becomes important before attempting any colorimetric estimation by means of standard solutions to decide which metal is really present.

I have been in the habit for a considerable time past of employing bichromate of potash for the identification of lead and consider it to be the most efficient and delicate test for the purpose as well as very simple and easy in the mode of application.

The following experiments have been undertaken to prove this :—

Taken—Standard solution of lead acetate, strength 0·1 milligram metal in 1 c.c.

—Canterbury water works water.

—Small crystals of potassium bichromate, potassium iodide and sodium sulphate.

Phillip's precipitating jars were used in every case.

Experiment 1.—143 c.c. standard lead made up to 1 litre with the water and divided into three portions. Strength, 1 grain of metal per gallon.

Sodium Sulphate.—Solution still bright in 24 hours. A very slight and doubtful deposit at bottom of glass.

Potassium Iodide.—Incipient yellow scales in half an hour. A complete deposition in 12 hours of yellow plumbic iodide.

Potassium Bichromate.—Immediate and very dense turbidity, precipitating in six hours, covering bottom of glass and considerable in amount.

Experiment 2.—28·6 c.c. standard lead in 1 litre water (strength 1-5th grain in gallon).

Potassium Iodide.—Clear and colorless solution 24 hours after. Slight trace of scales of iodide at bottom, but hardly visible.

Potassium Bichromate.—Immediate and considerable turbidity, depositing precipitate in six hours.

Experiment 3.—14·3 c.c. standard lead in 1 litre water (strength, 1-10th grain per gallon).

Potassium Bichromate Crystals.—Very pronounced turbidity at once.

Experiment 4.—7·15 c.c. standard lead in 1 litre water (1-20th grain per gallon).

Potassium Bichromate Crystals.—Distinct turbidity in 15 minutes.

Experiment 5.—3 c.c. standard lead in 1 litre water (1-50th grain per gallon).

Potassium Bichromate Crystals.—Distinct turbidity in 30 minutes.

In all cases the jars used were set alongside similar jars containing water free from lead and tested in same manner.

In every case where bichromate was used and sufficient time was allowed for subsidence, the colored water could be poured off to the last drop without disturbing the lead chromate, which latter could then be shaken with a little distilled water and its color and properties better observed than when in a yellow fluid.

I consider it of great importance that the re-agent should be added to the water in crystals and not in solution. The former is for some reason far more prompt and delicate in its effects.

I also find that for the production of lead iodide (a very characteristic precipitate by the way) a large quantity of potassium iodide is required for dilute solutions of lead.

Sulphates are no bar to the detection of lead in water by bichromate. 10 c.c. standard lead (= milligram metal) were evaporated to dryness with sulphuric acid, heated to expel excess of latter. Residue moistened with dilute nitric acid, 5 c.c. water added, boiled and a little sodium acetate added. A crystal of bichromate added to the cleared solution gave an immediate precipitate of lead chromate.

To conclude, about ½ litre of the water to be examined is brightened (if necessary) with a drop or two of acetic acid and agitated in a Phillip's precipitating jar with a few minute crystals of potassium bichromate. Lead, if present in the proportion of 1 part in 8½ millions, will be detected by the yellow turbidity or precipitate produced.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In compliance with the wish of many analysts we have decided to publish for the next six months the valuation of all the waters, the analyses of which appear in this journal, so as not only to enable the valuation scale itself to be put to a crucial test, but to give a clear indication of the variations which occur from time to time in the different waters.

In the following table we give the *average* valuation of the public supplies from January to June—the valuation of the analyses published last month (the June waters) and of those published this month (the July waters). We purpose using the January to June average valuation as a standard of calculation of improvement or deterioration, as the case may be, until the end of the present year.

	Average to June.	June.	July.
Kent Co.	30	23	27
New River	26	18	17
East London	32	36	39
Southwark and Vauxhall	34	30	28
West Middlesex	30	31	24
Grand Junction	30	25	23
Lambeth	37	29	29
Chelsea	39	26	26
Bath	12	11	19
Birmingham	33	33	37
Bradford	53	58	81
Brighton	24	26	23
Bristol	22	19	27
Cambridge	28	29	26
Canterbury	17	15	22
Croydon	27	28	30
Derby	18	14	13
Droitwich	39	..	..
Dudley	45	..	..
Edinburgh	28	25	21
Exeter	20	18	16
Grantham	27	30	..
Huddersfield	23	20	26
Hull	23	20	..
Ipswich	27	27	30
King's Lynn	94	131	110
Leamington	26	21	..
Leeds	35	34	28
Leicester	42	30	24
Liverpool	36	34	29
Llandrindod	13	..	..
Maidstone Water Company	39	42	34
,, Public Conduit	36	40	28
Manchester	22	19	17
Newark	39	..	46
Newcastle	37	38	40
Norwich	36	32	49
Nottingham	39	32	46
Oldham	23	..	..
Plymouth	29	..	..
Portsmouth	30	27	22
Reading	25	20	20
Rochdale	9	8	7
Rugby	41	58	..
Salford	18	21	14
Sheffield	22	..	..
Shrewsbury	23	18	..
Southampton	43	..	..
Stockport	17	..	..
Stourbridge	37	..	..
Stourport	37	..	..
Sunderland	25	..	27
Swansea	16	12	14
Warwick	34	..	34
Whitehaven	9	11	17
Wolverhampton	46	42	39
Worcester	55	..	..

Taking the Metropolitan waters first, we find that the Kent company gives a figure slightly worse than last month, but better than the average. The New River water shows an improvement over last month, and a considerable improvement over the average. The East London is worse than last month, and no less than 7 on the valuation scale worse than the average, although even now it falls within the limit of first-class waters.

The Southwark and Vauxhall, West Middlesex, and Grand Junction all show an improvement—most marked in the West Middlesex sample—whilst the Lambeth and Chelsea waters are practically identical in value with those published last month.

Taken as a whole, the average valuation of the London supplies for July is 27, a figure which contrasts very satisfactorily with a large number of the analyses published from places where the facilities for obtaining water are greater than in the case of the Metropolis. The figure shows that the London water, as a whole, is of good quality.

Dealing next with the provincial supplies, the lowest and, therefore, most satisfactory figures of valuation are those of Rochdale, 7; Derby, 13; Salford, 14; Swansea, 14; Exeter, 16; Manchester, 17; Whitehaven, 17; Bath, 19; Reading, 20. Of these nine waters, seven show a distinct improvement in the supplies of last month, and two—viz., Bath and Whitehaven—show a slight deterioration. In the Bath analysis the deterioration is shown mainly by the presence of algæ and diatoms accompanied by slight increase in the albuminoid ammonia. In the Whitehaven analysis the increase is due almost entirely to a marked change in the albuminoid ammonia, which, although still low, stands at a figure twice as high as last month.

There are eight other samples which show improvements on last month, and on the average of the previous six months, viz., Brighton, Cambridge, Edinburgh, Leeds, Leicester, Liverpool, Maidstone, and Wolverhampton; and in seven of these the improvement is of importance. In Edinburgh the decrease of valuation is 7; in Leeds, 6; in Leicester and Liverpool, 5; in Maidstone, 6; and Wolverhampton, 7.

Croydon, Ipswich, Newcastle and Sunderland show very little change.

There are six places where the character of the July supply appears to be worse than that of the previous month. Birmingham has an increased valuation of 4, Bristol of 8, Canterbury of 7, Huddersfield of 6, Newark of 14, Norwich of 17—and here the valuation is the highest yet recorded for that city. Nottingham has an increase of 14, but the valuation is not quite so high as in April and May. The supply of this town appears to be very variable in character. King's Lynn shows the highest valuation in the whole series, as, indeed, has generally been the case month by month. It is some slight satisfaction to note that the degree of impurity for July is somewhat less than it was in June, although still so high that the water must be ranked as at least third class.

Errata.—On page 122 in the paper on the Water Valuation Scale, the decimal point in the figure for Chlorine is omitted. It should have been ·50 grains per gall. = 1.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

Bolton.—This borough and its suburbs are supplied with water by gravitation from three sources, viz., Belmont, Heaton, and Entwistle. The drainage area extends over about 3166 acres; and the water is collected in five reservoirs, the total capacity of which is 940,500,000 gallons. The geological formations of the districts consist of the shales and sandstones, which constitute the lower portion of the coal series, and upper millstone grit. The average annual rainfall at Belmont and Entwistle is 55 inches, and at Heaton 45; the average amount of water which may be collected being about 40 inches. The present water supply is 5,200,000 gallons per diem. The sample analysed (see table of July waters) is a mixture, as supplied, from all the three sources, and may be taken as fairly representing the water now supplied to the consumers. Filtering beds are now (Aug., 1881) being constructed by the Corporation.

Hastings and St. Leonards.—The public supply of these towns is almost entirely obtained from wells ranging from 90 ft. to 350 ft. in depth, connected into sets of 3 or 4 each by headings. This supply is practically continuous, it being pumped into reservoirs (about sufficient for two days) and then conveved to the service pipes. Some of the waters containing iron are first pumped into ærating and filtering beds to free them. There are chalybeate springs in the neighbourhood. A little surface water is used, but this, though of fair quality, is being gradually dispensed with by sinking new wells in the districts where the purest water is found.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in July, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	July 19	pale blue	none	1·56	traces	·538	·0002	·0054	none	·0080	16·4°	5·6°	23·4	none	Wigner & Harland.
New River	„ 15	clear	none	1·14		·147	·0014	·0021	·0020	·0220	13·5°	2·0°	17 64	satisfactory	B. Dyer.
East London ..	„ 15	c. green. yellow	none	1·16	traces	·173	·0012	·0132	none	·0500	15·0°	3·6°	19 40	satisfactory	Wigner & Harland.
Southwark & Vauxhall ..	„ 18	c. f. yellow	none	1·24	trace	·090	·0014	·0070	·0028	·0476	13·5°	3·5°	17·64	satisfactory	J. Muter.
West Middlesex	„ 20	f. greenish yelw.	none	1·05	trace	·081	·0007	·0034	none	·0560	12·2°	2 1°	17 22	satisfactory	O. Hehner.
Grand Junction	„	pale yellow	none	1·04	trace	·096	none	·0047	·0012	·0424	12·6°	2 8°	18 40	satisfactory	A Wynter Blyth.
Lambeth	„ 19	c. f. yellow	none	1·24	trace	·090	·0007	·0070	·0028	·0560	14 0°	4·5°	18 76	satisfactory	J. Muter.
Chelsea	„ 13	c. greenish yelw.	none	1·26	trace	·140	·0010	·0050	·0040	·0450	13·0°	2·5°	17 64		A. Dupre.
Bath	July 15	c. f. blue	none	·96	none	·185	none	·0008	none	none	16·0°	4·0°	23 04	algæ & diatoms	J. W. Gatehouse.
Birmingham ..	„ 4	s. tur. grn. yelw.	none	1·19	traces	·139	·0021		·0080	·0740	12·2°	4·1°	18·50	veg. particles	A. Hill.
Bolton........	„ 5	s. yellow turbid	none	·40	none	·029	·0014	·0056	·0030	·0228	3 0°	3 0°	6·12	mineral & veg. debris	W. H. Watson.
Bradford......	„ 15	s. peaty yellow	none	·65	none	none	none	·0056	·0460	·2110	3·4°	3·2°		none	F. M. Rimmington.
Brighton......	„ 8	c. yelw. green	none	1·99	traces	·368	·0011	·0016	none	trace	12·8°	3·8°	20·60	vegetable debris	Wigner & Harland.
Bristol........	„ 11	f. green	none	1·10	trace	·050	·0010	·0014	·0020	·0100	14·6°	1·8°	18·40	none	F. W. Stoddart.
Bury (Lan.) ..	„ 11	turbid	mossy	·95	none	·034	·0040	·0092	·0070	·0246	4·4°	4·2°	7·04	veg. debris & minl. mttr.	W. H. Watson.
Cambridge	„ 4	c. pale blue	none	1·34	traces	·384	·0005	·0010	·0028	·0582	17·8°	4·0°	24·50	satisfactory	J. West-Knights.
Canterbury....	„ 20	c. pale blue	none	1·47	none	·412	·0005	·0007	·0050	·0110	17·0°	4·6°	23·66	very slight mineral	S. Harvey.
Croydon	„ 20	c. colourless	none	1·12	trace	·335	none	·0050	none	·0084	15·5°	6·0°	23·40	none	C. Heisch.
Darlington	„ 20	c. green. yelw.	s. peaty	·70	trace	·022	·0007	·0035	·0210	·2040	7·4°	4·4°	10 92	none	W. F. K. Stock.
Derby	„ 20	v. good	none	1·05	trace	·096	·0014	none	trace	·0092	10·1°	5·0°	19 18	satisfactory	L. Archbutt.
Edinburgh	„ 18	s. brown	none	·76	none	trace	·0008	·0048	·0096	·0448	4·7°	3 9°	5·76	none	J. Falconer King.
Exeter........	„ 5	f. greenish yelw.		·91	trace	·127	none	·0035		·0217	2·8°	2·8°	5·60		F. P. Perkins.
Hastings......	„ 12	v. p. yellow	none	4·5	none	·297	·0015	·0030	none	·0105	6·5°	3·5°	28 10	mineral matter	H. F. Cheshire.
Huddersfield ..	„ 14	f. yellow green.	v. faint	·55	none	·024	none	·0035	·0040	·0050	2·2°	2·0°	6·10	peat moving organisms	G. Jarmain.
Ipswich	„ 9	c. colourless	none	2·19	traces	·395	·0057	·0074	none	none	18·8°	8·6°	31·12	no deposit	J. Napier.
King's Lynn*..	„ 13	turb. brn. yelw.	weedy	1·59	h. traces	·350	·0014	·0119	·0252	·2140	10·0°	5·5°	17·08	veg. debris diatoms	William Johnstone.
„	„ 14	turb. brn. yelw.	weedy	1·63	h. traces	·360	·0018	·0142	·0280	·2265	11·2°	5·8°	18·52	moving organisms	
Leeds	„ 1	light yellow	none	·62	none	none	·0005	·0044	·0140	·0730	4·0°	2·9°	5·04	peaty matter	T. Fairley.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in July, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									2 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leicester......	July 19	f. yellow	none	1·15	trace	·103	·0013	·0032	·0027	·0745	7·7°	4·5°	14·44	satisfactory	W. L. Emmerson.
Liverpool	„ 18	yellow green	slight peaty	1·08	trace	·083	·0014	·0035	·0028	·0677	4·8°	4·5°	9 52	no deposit	A. Smetham.
Margate	June 28	c. blue	none	16·76	trace	·760	·0007	·0025	none	·0060	18·0°	10·2°	50·80	satisfactory	Wigner & Harland.
Maidstone—															
Wtr. Company	July 11	turbid	none	2·80	trace	·409	none	·0023	·0042	·0196	17·4°	5·6°	34·44	satisfactory	M. A. Adams.
Public Conduit	„ 11	clear	none	2·40	trace	·444	none	·0007	·0042	·0271	16·5°	5·6°	32·30	none	M. A. Adams.
Manchester....	„ 15	c. v. s. yellow	none	·73	none	none	·0033	·0045	·0032	·0439	2·0°	1·9°	5·73	satisfactory	W. Thomson.
Newark	„ 9	b. grn. s. turbid	none	1·75	trace	·026	·0022	·0074	none	·0689	17·0°	10·9°	34·24	diatoms and desmids	A. Ashby.
Newcastle-on-Tyne......	„ 8	f. yellow	none	·91	trace	·053	·0010	·0090	·0060	·1030	12·2°	4·7°	16·00	satisfactory	J. Pattinson.
Norwich	„ 16	p. greenish yelw.	none	2·10	trace	·061	traces	·0076	·0290	·0768	13·0°	4·0°	16·00	satisfactory	W. G. Crook.
Nottingham ..	„ 19	c. green. bluish	none	1·77	traces	1·000	·0005	·0047	none	none	15·0°	8·0°	20·60	vegetable fibres	Wigner & Harland.
Portsmouth ..	„ 13	clear	none	1·26	trace	·150	trace	·0014	none	none	13·4°	3 2°	14·50	decomp. veg. mttr. diams.	W. J. Sykes.
Reading	„ 13	c. greenish	none	·90	trace	·085	none	·0042	none	·0014	15·0°	4·0°	18·75	satisfactory	J. Shea.
Rochdale	„ 18	pale blue	none	·60	none	·008	·0015	·0028	none	·0004	3·4°	1·6°	5·00	satisfactory	T. A. Collinge.
Salford	„ 15	clear	none	·05	none	none	·0020	·0040	·0020	·0600	3·0°	2·5°	4 00	satisfactory	J. Carter Bell.
Sunderland ..	„ 16	c. colourless	none	1·85	trace	·288	·0023	·0030	·0020	none	9·6°	3·7°	24·50	vegetable debris	H. J. Yeld.
Swansea	„ 18	clear	none	·90	trace	none	·0010	·0056	·0030	·0040	2·5°	2·5°	3·57	none	W. Morgan.
Warwick	„ 8	greenish	none	1·40	trace	·231	·0007	·0028	·0170	·0390	18·4°	12·8°	21·70	none	A B. Hill.
Whitehaven ..	„ 12	v. s. turb. p. grn.	none	·36	trace	·005	none	·0023	none	·0158	0·4°	0·4°	2·10	vegetable debris diatoms	A. Kitchin.
Wolverhampton	„ 12	s. yellow tinge	none	1·36	trace	·605	·0003	·0042	·0013	·0638	12·6°	6·4°	20·16	confervæ and diatoms	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the June Table the Nitrogen in Nitrates in the Reading Water should have been ·088 instead of ·88, and in the Wolverhampton Water it should have been ·073 instead of ·051.

NOTE UPON DETERMINATION OF NITROGEN AS NITRATES, &c.

By Sidney Harvey, F.C.S.

Read before the Society of Public Analysts, on 27th June, 1881.

The figures appended to my successive reports upon the Canterbury water are *bona fide*, suspiciously close as they may appear. They have been determined with exceeding care, and illustrate, I think, the constancy and value of the aluminium process, which I have used for years and in which I have great confidence.

70 c.c. of water (or 7 c.c. diluted to 70 if nitrates are excessive in amount) are mixed with 20 c.c. of 10 per cent. caustic soda (free from N.) boiled to expel any free NH_3, cooled and aluminium in thin sheet introduced and left to stand overnight. Distilled next day and distillate (200 c.c.) nesslerized as usual (an aliquot portion of course). The flask in which the reduction takes place is closed with a cork pierced with a short length of thermometer tube, and is set in a place free from ammonia fumes and kept for that purpose.

Water Analysis.—If any of the Analysts engaged have used all the forms for the monthly reports and will send a line to the Secretaries, further copies will be sent to them.

Instructions for Water Analysis.—On page 135 we print a further part of these Instructions.

LAW REPORTS.

Adulteration of Milk:—

At the Belfast Police Court, Michael Marley and Francis M'Atamney were summoned at the instance of Wm. J. Anderson, sub-sanitary officer, for selling sweetmilk which was adulterated by water. Mr. James M'Lean, jun., prosecuted in this and the remaining cases. Mr. Harper appeared for the defendant. Mr. M'Lean said that this was about one of the worst cases of adulteration of sweetmilk that ever came before the Court since the Sale of Food and Drugs Act had come into force. The report of Dr. Hodges, the Borough Analyst, showed that in every 100 parts of milk there were 36 parts of water added as an adulterant. The second defendant was a servant of the first, and was selling the milk for him. He (Mr. M'Lean) thought that it was a case in which the full penalty of the statute should be inflicted. Mr. Anderson, having deposed to buying the milk and giving it to the analyst, said that the defendant Marley had been fined 40s. on a previous occasion for a similar offence. Captain Plunkett said that the public were defrauded by buying what they thought was a certain quantity of milk, and getting instead a quantity of milk and water. It appeared to him that a case of this sort should be in the other court, and not in the one it was. The defendant should be in the dock, as the offence was just the same as robbing a man in a clandestine manner. It was just the same with weights. The unfortunate public paid for one pound weight, and got a few ounces light, and the greater portion of them had no means of discovering it. The defendant Marley would have to pay a fine of £10 and costs, which was not a large sum, as it was only a matter of a few days' profit. The other case was dismissed.

John Grant was summoned for a similar offence. Mr. M'Erlean defended. The analyst's certificate showed that a similar quantity of water had been added as an adulterant. As it was the defendant's first offence, he was only fined 40s. and costs.

James Huddleston was also summoned by the same complainant for selling a quantity of buttermilk which contained 35 parts added water. A fine of 20s. and costs was inflicted.

Question raised as to whether analysis personally made by Public Analyst himself:—

At the Aston Police Court, William Lewis, jun., wholesale milk dealer, Fordrough, Potter's Hill, Aston, was summoned for selling milk adulterated with water. According to the certificate of Dr. Bostock Hill, the County Analyst, the milk which was purchased by Mr. Bolt, the Inspector of Nuisances, was adulterated with 27 per cent. of added water. Dr. Hill, who was present, was put in the witness-box, and in reply to the cross-examination of Mr. Vachell, who defended, said he did not and could not do all the manual work connected with the analysis of every sample of milk. But he always superintended them, and was invariably in the laboratory when they were being made by his assistants. Mr. Vachell said although he did not wish for a moment to impeach the accuracy of the analysis, he still submitted that the conditions of the act had not all been complied with. The 12th and 13th sections provided that the analysis must actually be made by the analyst himself. It was not sufficient for him to have it made by others, however skilled they might be. The Bench said they were quite satisfied Dr. Hill had complied with all the requirements of the Act. He told them that he employed competent assistants, and they (the Bench) thought it would be unreasonable that he should be required to actually perform every detail himself—it would be utterly impossible. The defendant would be fined 40s. and costs. Mr. Vachell asked for a case. He said the point was of some importance to milk sellers in general. The Bench granted a case.

At the Town Hall, Leeds, lately, Mr. Bruce gave judgment in a case which was before him on the 15th March, and in which Jabez Smith Blanchard, provision dealer, Kirkdale, was summoned for selling as butter an article known as butterine. Mr. Beverley, barrister, who appeared for the defendant (having been instructed since the case was last before the Court), contended that as the defendant had affixed to the article which he sold a label intimating that it was butterine, he had complied with the Act as much as if he had labelled it as a "mixture." The Town Clerk (Mr. G. Morrison), who prosecuted on behalf of the Corporation, objected to Mr. Beverley addressing the Court after the case had been heard. Mr. Bruce in giving judgment, said this was an information against the defendant for selling, to the prejudice of the purchaser, an article of food which was not of the nature, substance, and quality of the article demanded by the purchaser. In this case the article demanded by the purchaser was 1lb. of shilling butter. The article sold was 1lb. of something which, on analysis, turned out to be: Moisture 9·37, curd 3·06, salt 3·55, and fat 84·02. Of the fat at least 90 per cent. was foreign fat—not butter at all. If any real butter entered into the composition of the mixture it must have been infinitesimal in quantity. The defendant did not, in fact, pretend that the mixture thus sold was butter, but he sought to protect himself from the operation of the statute by the fact, which was admitted by the prosecution, that the shopman by whom the sale was effected handed the mixture to the purchaser, who could not read, in a paper upon which were endorsed in legible printed characters the words, "Extra superfine butterine," and by the alleged fact, which, however, was disputed by the prosecution, and as to which he (Mr. Bruce) found for the prosecution, that on the purchaser asking for shilling butter, the seller said, "Do you want the shilling butterine?" He (Mr. Bruce) had reserved his judgment in order that he might consider whether the defendant was protected by 38 and 39 Vict., chap. 63. He was of opinion that the mere words "Extra superfine butterine" on the paper did not amount to a notice to the effect that the same was mixed, but as the defendant had merely substituted the word "butterine" for "butter," it would not necessarily convey to the mind of the purchaser the fact that the article was a mixture of butter and something else, or a mixture in which the something else was everything and the butter nothing. There was nothing on the label necessarily to convey to the mind of the purchaser the idea that he was buying anything but pure butter with a finer name. The Town Clerk said he understood that the defendant had filed a petition. The defendant was fined £5 including costs.

Adulterated Cayenne Pepper:—

At the Sheffield Town Hall, a grocer was charged with selling cayenne pepper which was certified by Mr. A. H. Allen to contain 6 per cent. of red lead. The defendant pleaded ignorance of the fact, and said he had had the pepper in stock for upwards of ten years. He was fined 5s. and costs

At the Birkenhead Borough Police Court, lately, before Mr. Samuell, the adjourned summons against James Stewart, of 3, Claughton Road, milk seller, for selling skimmed milk, came on for hearing. Mr. Waln prosecuted on behalf of the local authorities, and Mr. Spence appeared for the defendant. At the previous hearing, Mr. Smith, inspector of milk, had proved the purchase of a pint of milk on the 27th May, and had put in a certificate from Dr. Vacher, the Borough Analyst, stating that the milk had been deprived of 15 per cent. of its cream. Mr. Moore, who appeared for the defence on the previous occasion, had produced a certificate from Dr. Campbell Brown, Public Analyst for Lancashire and Liverpool, relative to the quality of the milk, but this had been ruled to be inadmissible, unless Dr. Brown was present. Dr. Campbell Brown was now in court. Mr. Spence urged a number of minute technical objections, all of which were overruled, except one as to the inadequacy of the certificate. With regard to this the magistrate expressed his opinion that the certificate was all that the act required; but, as it might be desirable to have more information as to the constituents of the milk, he was willing to adjourn the case in order that it might be more fully set out. Dr. Vacher said he had his laboratory book in court, and was quite prepared to give any particulars. Having been sworn, he stated in answer to Mr. Spence that in analysing the milk he first weighed out 10 cubic centimetres of milk, which weighed 10·829 grammes. In ascertaining the proportion of solids, instead of totting up to 100, he totted up to 102·9, a very usual mode, and then the constituents came out:—Water, 90·21; Fat, 1·70; Solids, not fats, 10·99; total, 102·90. The ash was 0·70. The result of the analysis was to show that 15 per cent. of fat had been abstracted from the milk. The standard amount of fat that he required was 2·00 but the sample showed but 1·7. He had analysed milk in which the fats were as high as 6·08, but if the sample had come up to 2·00 he should not have certified against it. Mr. Spencer asked Dr. Vacher what was his experience as an analyst, and if he had not been unsuccessful in three or four examinations; but Mr. Samuell said he could not go into that, and it was not a proper question to ask. He was satisfied that the Corporation of Birkenhead had appointed a fit and proper person to be the Analyst of the Borough, and he was not the person to examine Dr. Vacher as to his qualifications. He might as well ask Mr. Spence if he knew more law than Mr. Waln, or *vice versa.* Dr. Vacher said it was not the fact. He was never plucked at any examination. Dr. Campbell Brown, was then called and stated that on the 4th of June he received a bottle of milk from Mr. J. Stewart, who was accompanied by another farmer. The bottle was sealed with a red seal marked "C.I.N. Borough of Birkenhead." The seal was intact and had not been tampered with. He produced the bottle. When he received it the seal was in better condition than that of the third, and as yet untouched, sample produced by the Inspector. Mr. Samuell said it appeared a very insecure method of sealing the articles. He could draw the cork of the third sample without injuring the seal. Dr. Vacher, who was examining the empty bottle produced by Dr. Brown, said it appeared to have previously contained sweet oil, which would add to the quantity of fatty ingredients in the milk. Chief Inspector Smith said the bottle was clean when he filled it. He believed it previously contained spirits. Dr. Brown said it was butter and not oil that was in the bottle. He analysed the milk. He found lumps of butter floating about in it, caused by the churning it had received in its journey, sufficient to show that it must originally have been a rich milk. Having taken out the lumps of butter he ascertained the quantity of fat in them, and found it of itself to be more than Dr. Vacher had extracted from the whole of the milk. Then he analysed the milk that remained and found an additional quantity of fat which had not been converted into butter, and that, added to the butter found floating, made a total of 2·83 per cent. of fat, a standard somewhat above the average of good Cheshire milk. He did not at all find fault with Dr. Vacher's standard, it was rather lower than his own; therefore it was merely a question whether Dr. Vacher got the whole of the fat out of his sample of milk. There was internal evidence quite sufficient to show that Dr. Vacher failed to get the whole of the fat out. The proof of that was that he found 10·99 solids not fat. That was almost the total solids found in ordinary pure milk as it came from the cow with the fat still in it. Whenever he got a result like that from an analysis he knew that he had failed to get the whole of the fat from the preparation, and he did the analysis again. It was an exceedingly rare thing to get anything like 10·9 solids not fat; 9·2 or 9·3 were much more common. Deducting 9·3 from 10·9 left a difference of 1·6, and this was probably the quantity of fat that Dr. Vacher failed to extract. Mr. Samuell: Then your contention is this: that a portion of the solids which Dr. Vacher classed as solids not fats ought to have been a portion of fat? Dr. Campbell Brown said there was no doubt about it in his mind, from Dr. Vacher's own analysis, and that allowance would make it correspond with his, or, in fact, show the milk to be somewhat richer. That would be accounted for by the fact that when he analysed the milk it was a fortnight old, and the solids, not fats, had decreased by decomposition. Dr. Vacher said he could not think with Dr. Brown that the solids not fats never reached beyond the point of 9·2 or 9·3. Dr. Brown said it was extremely rare for them to be beyond 9·5. The standard adopted by the Society of Public Analysts was 9·0. Dr. Vacher quoted a work by Dr. Wanklyn, but Dr. Brown said Wanklyn was not worth anything for judicial purposes, because he put forward a number of analyses of milks at much higher standard than were commonly met with. If Dr. Vacher would become a member of the Society of Public Analysts, he would be aware that the matter had been very fully discussed by them, and that they had fixed on a standard of 2·20 for fats, and 9·00 for solids not fats. Dr. Vacher, by working up his standard, would in two cases out of ten prosecute for the addition of water where no water had been added. He (Dr. Brown) had done over 9,000 milk analyses up to the present, and something like two out of ten would have been below the mark if the standard of solids not fats was put as high as 9·60. Dr. Vacher asked Dr. Brown whether, the two samples being analysed, one in a fresh, the other in a sour condition, the results obtained by the analyst who analysed the fresh would not, *ceteris paribus*, be more likely to be correct than those of the analyst who analysed the sour. Dr. Brown replied that the answer to that was that there was a regular diminution of the solids not fats owing to the decomposition of the milk, and allowance was therefore made corresponding to the age of the milk. Mr. Samuell said this was a very interesting discussion, and he would sit and listen to it with a great deal of pleasure, but he did not think it would aid him in forming his judgment in the case, because where two gentlemen disagreed so markedly as in this case as a matter of course nothing remained for him but to dismiss it. Summons dismissed with costs.

At Bath, William B. Beauchamp, 6, Abbey Church Yard, was summoned for having on the 30th May sold to H. G. Montagu, an inspector under the Sale of Food and Drugs Act, one pint of milk, which was not of the nature, quality, and substance demanded. Mr. Moger prosecuted on behalf of the Sanitary Committee, and Mr. A. R. Poole, defended. Inspector Montagu deposed that on the 30th May last he visited No. 6, Abbey Church Yard, of which the defendant is the registered owner. He asked the female in the shop for a pint of new milk. She served him, and he told her he had purchased it for the purpose of being analysed by the Public Analyst, and asked her if she would have it divided into three parts. She said she would, and he accordingly divided it and put the milk into three separate bottles, which were sealed. He retained one bottle of the milk himself which he produced. He received the certificate from the Public Analyst in due course. He gave the ordinary price for the milk. He took six samples of milk that day, or which he gave the same price with one exception. By Mr. Poole: He had no regular time of calling on the dairymen. He had called at the defendant's shop before. He usually called on the dairymen about once a month. He did not pay particular attention to any one establishment. The milk he was served with was taken from a metal vessel on the counter. It was not taken from a pan behind the counter. He could not say whether the milk had been standing in the shop all day. He was supplied with the milk as new milk. By Lieut.-Colonel Ford: The shop-woman did not say that the new milk had not arrived. Mr. J. W. Gatehouse, City Analyst, was called and examined at some length by Mr. Poole for the purpose of showing that the feeding of cows and the differences in the animals themselves together with the season of the year made a difference in the quality of the milk. His standard of milk was 2·2 of fat but the average should not really be lower than 2·5. In this case he only found 1·48 of fat. He did not know whether that standard was higher than that at Bristol. If the greater portion of the milk had been sold in the morning and had then remained standing without being disturbed, there would have been a considerable formation of cream at the top of the milk. By agitation the cream would return and mix with the milk. It was possible that in the ordinary mode of dipping the first customers would get the richest milk. Continuing his evidence, Mr. Gatehouse said the quality was no better than skimmed milk. Mr. Pool addressed the Bench for the defence, and criticised the evidence given by the analyst and said he should call evidence to prove that the milk had not been tampered with in any way whatever. It was treated in the way in which milk is ordinarily treated, and if the earlier customers got milk of a rather better quality than the others it was not done with a fraudulent intent of any kind. In a case like this he contended that it was never intended any penalty should be inflicted by the legislature. Referring to the hour the inspector called for the milk, he said it was just at the time when the morning's milk would be in its poorest state, and it was, he urged, unfair of the inspector to call at that time of the day. Emanuel Green, farm bailiff to defendant, was called and deposed that all the milk was taken direct from the cows and sent in locked tins by rail to Bath. Witness saw the cows milked. As a matter of fact the first customers would get the best milk. Emily Candy deposed to having received the milk in question from which the inspector was served. The milk was served out of the trunk to customers, and was never tampered with in any way. At the time the inspector called there were about 3 or 4 gallons left. She had been accustomed to serve milk, and knew it to be a fact that milk at the bottom was poorer than at the top. This could not be avoided. If the cream were stirred it would float on the top but would not return to the milk. Mr. Lewis Vigis, chemist, 24, Monmouth Street, Bath, said from time to time he had examined defendant's milk. His opinion was that the milk became poorer as it was served out. After a short deliberation the Bench dismissed the case.

Important:—

Recently a special case was stated by the Magistrate of the Thames Police Court at the request of W. T. Harrison, one of the sanitary inspectors of Poplar, to the effect that he, the magistrate, had dismissed a complaint by the inspector against Henry Richards, a milk vendor, that the latter had sold milk adulterated with 20 per cent. of water (in support of which complaint the certificate of the Public Analyst for Poplar to the effect that the said milk was so adulterated was produced), on the ground that he, the magistrate, was of opinion that the said milk might have been a sample of very poor but genuine milk, from which some of the original richness had been abstracted by ladling out for sale, and that though he received the certificate of the said analyst as evidence of the constituents of the said milk, he was of opinion that it was for him and not the analyst to decide as to the fact of adulteration. After argument before the Queen's Bench Division of the High Court, the Judges remitted the case back to the magistrate with their opinion that his judgment was erroneous.

We quote the following from the *British Medical Journal* of the 23rd July. We cannot at all agree with the comments made, and if 30 per cent. of water in butter milk is not "flagrant adulteration" we should very much like to know what is.

PROSECUTION UNDER THE SALE OF FOOD AND DRUGS ACT.

There has just been given a decision of some importance in reference to the above Act. A farmer was recently convicted in Lancashire for selling butter-milk which, on analysis, was found to contain 30 per cent. of water; it being contended by the official analyst that 20 per cent. was a sufficient quantity of water to use in the process of churning. Evidence was brought for the defence to show that there could be no uniform percentage, as it depended on the temperature, sometimes as much as 50 per cent. of water being necessary. Notwithstanding, a conviction was obtained. An appeal was made, and the judges at once unanimously reversed the decision given in the lower court; and we cordially agree with their remarks, that the case was one which should never have been undertaken by the authorities. These latter should bear in mind that an Act such as the Sale of Food and Drugs is to put down flagrant adulteration, and not to be used as an agent for harassing different opinions on slender and insufficient grounds.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
4865	F. M. Lyte	Manufacture of Sugar	2d.
4932	F. M. Lyte	Treatment of Ores or Metallic Mixtures	4d.
4900	H. W. Parrott	Treating Night Soil for Manufacture of Manure	2d.
4908	H. G. Grant	Manufacture of Ammoniacal Salts	2d.
4933	J. W. Swann	Electric Lamps	6d.
4985	T. Morgan	Manufacture of Soda	6d.
5287	B. E. R. Newlands	Manufacture of Sulphate of Alumina	4d.
3471	W. Chadwick and J. Kynaston	Separating Ferrocyanides of Iron from Liquids containing the same	4d.
4869	J. Hargreaves	Manufacture of Sulphates of Soda and Potassa	6d.
4987	C. D. Abel	Manufacture of Compounds of Sugar and Lime from Molasses, &c.	2d.
5030	W. R. Lake	Manufacture of Manure	2d.
5033	J. H. Johnson	Electric Lamps	2d.
5037	E. Parnell and A. French	Obtaining Sulphate and Oxide of Zinc from Cupreous Ores	2d.
5066	M. De la Vega	Manufacture of Sugar	4d.
5231	H. Stokes	Manufacture of Sugar	6d.
5332	J. Eckart	Preserving Meat	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; Analysis of Simpler Salts, by H. A. Phillips; Report of The People *v.* Schrumpf, New York.

THE ANALYST

SEPTEMBER, 1881.

THE NEW YORK ADULTERATION ACT.

We have pleasure in drawing attention to the reprint of the Adulteration Act for the State of New York published in our present number. It is, in our opinion, without doubt the most complete and perfect anti-adulteration Act that has yet been passed in any country. The advantages which it possesses over our own English Act are evident. A definition of adulteration, both as regards food and drugs, is contained in the Act itself, and that definition is such that it would be impossible, as far as we can see, to raise the foolish quibbles which from time to time have been raised in the administration of the English Sale of Food and Drugs Act.

The New York law also contains a special proviso by which it would not only be possible, but the duty of the State board of health to procure and publish from time to time a list of articles, mixtures, or compounds, which are exempted from the provisions of the Act.

The penalties to be imposed are moderate but decisive, and from the way in which the board of health are going to work at the present time, and judging from the reports in the *Sanitary Engineer*, which has been the leading paper in New York in carrying the matter so far through, we think there is no doubt that within a few months the Adulteration Act will be working in the State of New York in a more satisfactory manner than our own is, even after several years of friction and worry over technical grounds which have been raised by acute solicitors simply with the view of enabling those who really have been guilty of offences under the Act to escape from its penal consequences.

ON THE FIGURES OR PATTERNS WHICH DROPS OF VARIOUS FATS ASSUME UNDER CERTAIN CONDITIONS.

By A. Wynter Blyth, M.R.C.S.

Read before the Society of Public Analysts, on 27th June, 1881. *(Illustrated.)*

I know of no notice of the curious patterns which may be obtained by simply melting any fat and dropping it in the fluid state, on to water or on to smooth wet surfaces.

The general method is to melt the fat and then to drop it from a small glass rod held a few inches above the surface of water or moistened glass. Immediately the drop touches the water it solidifies in a definite form.

To attain success it is necessary that the fat as well as the water should be of a certain temperature, but with many of the glycerides and mixtures of glycerides, such for example as butter, butterine, dripping, &c., the range is very wide, so that if the fat is perfectly fluid and not above 100° C, and the water ranges from 0° to 15°, a pattern more or less perfect is obtainable.

Each fat appears to have its own distinctive pattern and can be identified by its pattern alone. On the other hand each fat has a variety of patterns, for every alteration of the experimental conditions modifies more or less the form of the congealed drops. If, however, the conditions under which each experiment is performed are precisely similar, then there is no difficulty in obtaining the same form or at least very similar forms any number of times.

The chief modifying conditions are the difference of temperature between the fluid fat and the water and the height from which the fat falls. I have found that from three to four inches is the best height, and that a greater fall than this tends to spread the films out and renders all patterns more or less similar.

Referring to individual forms—

Butter.—The experiments were made on several samples of genuine butter, as proved by analysis. The fat was melted and filtered and kept in an air bath at temperatures of from 40° to 80°, and then dropped from a clean warm glass rod on to water of from 10° to 15°. The most common and distinctive form obtained in this way was that of a beautiful foliated film not unlike the leaf of a pelargonium. Figs. 6 and 7 are accurate representations of the outline of these films, for they have been obtained by a process by which I have been enabled to transfer the film direct to the lithographic stone and thus have a direct impression. The details of delicate veining are, as might be expected, lost. The best pattern temperature for butter is 55°, the water being at 10°; but regular forms may be obtained up to 100°. At higher temperatures success is rare. I found that although butter of 40° to 50° when dropped on to water of 10° sets in a radiated star form, yet when dropped on to water of 8°, although momentarily there was a beautiful complicated foliation with many radiating wings, these wings suddenly mutually repelled each other, and the pattern fell or rather flew to pieces. Glass plates were prepared chemically clean by first treating with alcoholic soda and then washing with ether; the plate was then dipped into water and thus a thin water film obtained. On this perfectly smooth wet surface, butter and other fats were dropped. In the case of butter, the pattern lost much of its beauty, but was always very regular in outline. Figs. 1, 3 and 5 represent butter patterns on glass, and Fig. 2 an imperfect pattern on water. This is a very common form when the fat is not quite hot enough. In this case it was but three degrees above its melting point. Butter films are of extreme tenuity, and although several attempts to photograph them were made the light passed through almost as perfectly as through glass, therefore the photographic shadows were too indistinct to make any use of.

Butterine.—The various mixtures of animal fats in the market known as butterine or artificial butter give by no means identical patterns for they vary much in composition, but in each case the form can be distinguished from the butter films, and from the pattern alone it is always possible and often very easy to say whether a given film is butter or not. The best method to distinguish the artificial from the genuine product, is to take pure butter fat and the suspected sample and after melting them each at the same temperature to drop them on to the same glass plate side by side. Fig. 1 and Fig. 4 are patterns of pure butter and butterine treated in the manner suggested. The latter is full of minute crystals and is decidedly different in outline. All butterines examined have been found to possess this crystalline peculiarity. The

Supplement to "THE ANALYST," September, 1881.

ILLUSTRATING MR. WYNTER BLYTH'S PAPER ON PATTERNS OF FATS.

Fig 1.

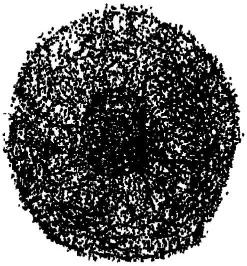


Fig. 2:

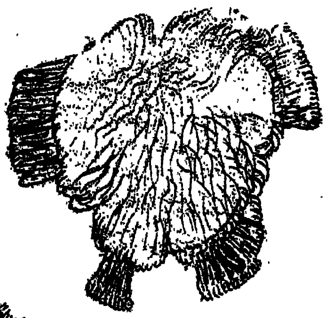


Fig 3.

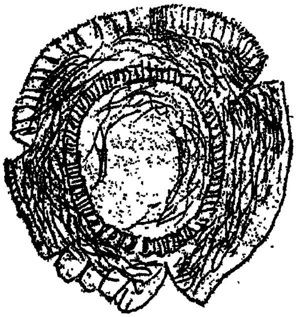


Fig 4.

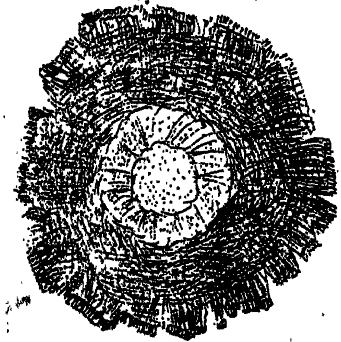


Fig 5

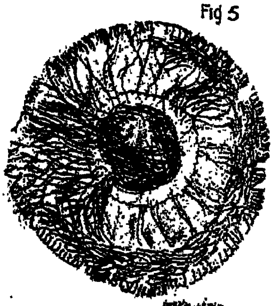


Fig 6.

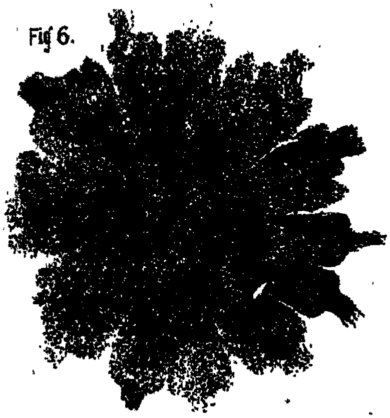


Fig 7.

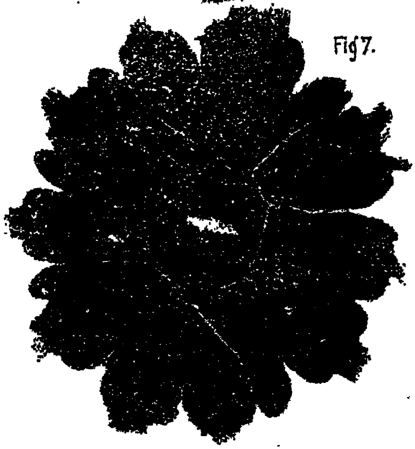


Fig 8.

Fig 9

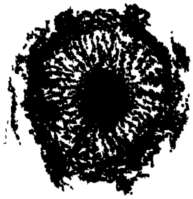
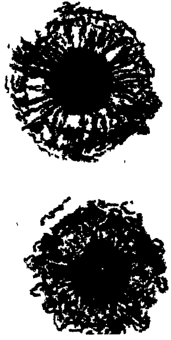


Fig. 10.



pattern of one sample of butterine was found to be identical with that of tallow—little white dots containing bunches of crystals.

Tallow.—One form of tallow pattern has just been alluded to. It is the most common form when melted tallow falls on to water. This fat of high melting point is a good illustration of the many forms which may be produced at different temperatures. Thus at 82° the fat sets on to water in circular indistinct drops, but when more fluid and dropped on to glass its pattern is distinctive and crystalline.

Paraffin, giving no pattern by itself, when mixed with other animal fats as may be expected, profoundly modifies the film. Fig. 8 represents the pattern obtained by suitable treatment when equal parts of the hydrocarbon and stearic acid are mixed. The various figures which mixtures of different fats may be made to assume are represented in the accompanying photographs and drawings, and need no further description. With reference, however, to the fat-patterns of spermaceti, stearic acid, and generally fats of high melting points, it need scarcely be said that it is impossible to obtain them by dropping the fat on to cold water. Such a proceeding only gives a shapeless mass. To be successful it is absolutely essential that the water of the glass plate should be warm. For example, spermaceti gives no definite form when melted at 100°, and dropped on to cold water or even water of 50° the water must be heated up to 80° or 90° for a good result to be obtained. Very beautiful lace patterns are produced by wetting a warm glass plate with absolute alcohol and dropping tallow, stearic acid or spermaceti upon it; all the finer portions of the film are at once dissolved, while the veins and denser portions remain, reminding one of skeleton leaves (Figs. 9 and 10); the thin films of butterine, dripping and the like, will not stand this treatment, but are at once dissolved.

Cohesion Figures.—Tomlinson *(Phil. Mag.*, 1861 and 1862*)* some years ago drew attention to the peculiar cohesion figures of various liquids and oils, but the patterns of the solid fats when melted and dropped on to warm water do not appear to have received any consideration. I find, however, that each solid fat behaves differently, and may also in this way be identified and any admixture generally be correctly surmised. Should the water be at such a temperature as to keep the fat very fluid it rapidly spreads over the surface of the water, breaks up into lacunae, shows a beautiful iridescence, and the phenomena is over so rapidly as to leave but little impression on the memory. I therefore prefer to operate at temperatures just sufficient to keep the fat a little fluid so that the action takes place in a slow regular and methodical manner. As an example, one experiment may be detailed. Filtered pure butter fat, butter adulterated with 5 and with 10 per cent. of lard, and lard itself, were all put in the same air bath and brought to 55·5°. A large flat dish made chemically clean was filled with water of 44°, and a single drop of each of the four fats was dropped simultaneously on to the surface of the water and their behaviour noted. The butter drop immediately spread itself out into a thin film, became agitated by a rapid circular motion, and threw off minute droplets of butter fat. The motion gradually ceased, the drop extended itself, became irregular in outline, crenated at the edges and then contraction took place. At this stage its appearance was that of an irregular square, surrounded by small circles at distances from the central square and from each other of some three diameters. Both butter drops containing 5 and 10 per cent. of lard respectively, flattened out with extreme slowness, were agitated by a gyratory motion, threw off no droplets of fat, and ultimately broke up with extreme slowness. It was noticed that the 5 per cent. drop was thinner and larger than the 10 per cent. The drop of lard underwent no alteration, remaining circular and quiescent up to the moment of solidification. It is obvious that this method is capable of great extension and may be found of practical value.

In reply to questions Mr. Blyth said that in no case did a mutton fat give a pattern like butter, and some of the mutton fats were heated and melted 30 or 40 times and kept for a long time—some more than a fortnight—above the melting point of mutton fat. In no case, however, could he have mistaken it for butter, and besides that there was always a film that could be photographed, but the fine butter films could not be; a sort of shadow might be obtained but no photograph, as was the case with animal fats. As to the vessel being chemically clean, he had thought at first that it should be so, and he took a lot of trouble for that purpose, but he found that was unnecessary; all that was wanted was the still surface of water. Ordinary vibration from traffic would not make any difference unless it caused a ripple.

ON A NEW BURNER FOR GRIFFIN'S GAS MUFFLE FURNACE.

By W. F. K. Stock, F.C.S., F.I.C.

Read before the Society of Public Analysts, on 27th June, 1881.

After a year's experience of the working of Griffin's Gas Muffle Furnace for ignitions at a high temperature, I can only express myself as very well satisfied with its convenience, compactness and cleanliness. As an apparatus for general purposes, however, it has serious faults. In my hands the chief of these have been the impossibility of controlling the temperature sufficiently to allow of the safe incineration of organic substances—of which milk residues may serve as a type, and the rapid corrosion of the metal tubes of the burner, when both air and gas were checked to furnish less heat.

Being anxious to remedy these defects, I made many efforts to construct a clay burner, which could be used for any desired temperature, and after numerous failures I succeeded in producing one which will, at pleasure, give a heat sufficient for the combustion of the hardest gas carbon, or for the safe incineration of milk residues, or other matters liable to injury from fusion, or volatilization of constituents. I may here say that I offered the burner to Mr. Charles Griffin for a consideration; but, whilst speaking favourably of it, he declined it because it would not give heat sufficient for the melting of cast iron in crucibles in the muffle. I, of course, only intended the burner for the use of analysts, and as an analyst, I have used a muffle almost daily for nearly seventeen years without even once having had occasion to melt cast iron in it. I felt also that the new army of Food Analysts wanted a burner which should be certain in its operation at any temperature between faint red and bright red, and I was determined that the power I had acquired in my new burner should not be lost to Public Analysts.

Unaided by woodcuts I can best describe the new burner by saying that it is simply a circular plate of fire-clay, exactly seven-eighths of an inch in thickness, pierced with twenty-seven holes a quarter of an inch in diameter. The lower part of this clay-plate falls into and fits closely the seating provided for Griffin's metal burner, und the upper part of it stands half an inch or so out of the seating, and is made exactly of the diameter of the hole in the sole plate of the furnace; and round this upper part, which is somewhat less than the circumference of the seating, is placed a narrow iron hoop so as to bind the whole well together. When fixed for use the clay burner rests on a disc of wire gauze of sixteen meshes to the linear inch, and when intended for low temperatures the air supply is checked by sliding on to the foot of the air-tube of the burner a short bit of telescope tubing carrying a diaphragm. Thus modified, Griffin's Muffle Furnace will do anything a muffle furnace ever ought to do. I have myself used it within half an hour for the assay of ash in hard Durham coke, and the assay of ash in tea. For incineration of milk residues it is perfect; and a few moments suffice to raise the temperature from that point to a degree perfectly ample for the conversion of calcium carbonate to oxide. In conclusion, it may be well for me to add a few words as to the fixing of the burner and as to supply of gas. When in its place the face of the burner must not approach within three-sixteenths of an inch off the lower surface of the sole-plate of the furnace. The existence of this space is necessary to the proper supply of air. The gas must not, on any account, burn up the chimney as in the old burner. All gas burnt thus is wasted. In lighting the gas a neat method of procedure is the following:—Move back the chimney, close hole in top plate with a flat tile, put the tube, with diaphragm, on to the foot of the air tube; close the diaphragm, turn on the gas and apply a light to the edge of the clay-burner. The gas lights up quietly. The tile is removed from the top, chimney replaced, and the diaphragm opened, leaving the furnace in full operation. It is scarcely necessary to say that the muffle stoppers must be taken out, and the muffle left open during the lighting.

This paper is in no way intended as an advertisement. There are only two of the burners in existence, so far as I know. One is working on my muffle furnace, and the other I have deposited with Mr. Wigner. The latter burner has been knocked about a good deal, having made the journey to London thrice, and been worked on my furnace for a week, and then tried on Mr. Griffin's. Both burners were made in a tin mould in the laboratory. The one with Mr. Wigner has the holes made too large for very low temperatures.* The clay is a mixture of one part pounded and sifted firebrick, and two parts pipe-clay. The burner needs no firing before use. After gentle but perfect drying it may be carefully ground down to its place, and then the fire-clay dust forms a gas-tight lute.

To sum up: The advantages of the new burner are these, viz.:—

1st. Perfect control over the temperature.

2nd. Ready adjustibility of the temperature.

3rd. Low cost (exclusive of time, fifty could be had for ten shillings).

4th. Indestructibility.

5th. Economy of Gas, thirty-four feet per hour being sufficient for a bright red heat.

6th. Non-liability of flame flashing back.

Date Coffee.—According to the reports of the recent meeting of the shareholders of the Date Coffee Company, on the 12th July, the Chairman stated that by the end of August the Company would be in a position to put out close upon 40 tons per week. It is possible that some proportion of this may be sold by retailers as coffee, or as an admixture of chicory and coffee. It will be desirable to examine samples carefully to see if this be the case.

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* The holes in my burners were cut out with a brass cork borer, whilst the clay was still somewhat moist but firm. If the burner could be made in plumbago clay it would be much improved.

THE ESTIMATION OF QUININE IN QUININE WINE, TINCTURES, &c.

By A. Wynter Blyth, M.R.C.S.

Read before the Society of Public Analysts, on 27th June, 1881. *(Illustrated).*

Having had occasion to make several estimations of quinine in the quinine wines and tinctures of commerce, it became necessary in the absence of any definite information in the text books, to independently investigate the best methods of procedure.

The Formula.—I have found hitherto nothing but the seven hydrate in common use. I therefore think that when any article is sold with a label describing it as containing so much "quinine," that we are justified in considering the word "quinine" to signify sulphate of quinine, and that sulphate of quinine to have the formula $(C_{20}H_{24}N_2O_2)$ H_2SO_4 $7H_2O$. That is—

Quinine $C_{20}H_{24}N_2O_2H_2O$	76·4 per cent.
SO_3	9·8 ,,
$7\ H_2O$	13·8 ,,

In an actual determination of the quinine, precipitated from a solution of pure sulphate of quinine, the precipitate dried at 100° equalled 76·5 per cent., and generally speaking the error seems to lie a little on the side of over-estimation. However that may be, quinine precipitated in small quantity by an alkali, and dried at the temperature of boiling water, may I think be fairly calculated into sulphate of quinine by multiplying its weight by the factor—1·3.

Mayer's Reagent.—Mayer's reagent, made by dissolving 13·456 grm. of mercuric chloride and 49·8 grm. of potassic iodide in a litre of water, gives a dense white precipitate with the feeblest trace of quinine. When operating on solutions of quinine sulphate in pure water, the assay can be made as expeditiously by suitable arrangements as any titration of an alkali by an acid with the usual indicators. To use the reagent I employed a very simple mechanism which I will call a filter tube (see Fig. 2). Take a glass or tube, enlarge its end funnel shape in the flame (A), cut the minute funnel off at A., cram it with glass wool, slip it on to the end of another tube by means of a close yet easy piece of rubber. By the aid of this filter tube you can suck up a clear drop of the liquid, and by placing this clear drop on a black plate the addition of a droplet of the reagent at once shows if the quinine has all separated or not. When, however, you add "Mayer" direct to the wines and the like, the precipitate instead of being flocculent and rapidly separating, is so excessively fine that however tightly you pack your filter tube it is difficult to get a really clear drop, and the process though still accurate becomes tedious, consuming much time.

Dissolving known Quantities of Quinine in Wine.—Accurate results were obtained to the second decimal place, and therefore with the exception of time it compares favourably with estimations by weight. Mayer recommends the concentration of the solution to be as 1 : 800, and under these circumstances he says that each c.c. is equal to ·0108 grm. of quinine. But my own experiments show that this is not to be depended upon, and it appears probable that the value varies according to the temperature of the solution. For the "Mayer" precipitates are generally very soluble in warm water, reappearing as the solution cools. I would therefore recommend each time that the standard solution of quinine and the wine to be assayed be first brought to exactly the same temperature and the solution of quinine made so as to be of the same strength as the solution to be examined should be, and then the number of c.c. in each case required accurately found.

Scheibler's Reagent.—Known quantities of quinine were precipitated by "Scheibler." The precipitate separated by filtration and then shaken up with strong soda and ether in the tube to be described. Here absolutely accurate results were obtained, but it did not compare favourably in respect of time with the next process.

Ether and Alkali Process.—In order to make the old-fashioned ether process expeditious and accurate I devised a new tube, which has since been found most useful and in fact indispensable for the separation quantitatively of volatile solvents when used for the recovery of substances from liquids. The tube A. (Fig. 1) may be of any convenient length or diameter to suit the analyst (ordinary burette size will do). It is furnished with a stopcock and bent beak B. of small, almost capillary bore. The lower end is attached to a long piece of pressure tubing, which is also connected with a small reservoir of mercury capable of being raised or lowered by a pulley. To use the apparatus raise the reservoir, after opening the stopcock, until mercury flows out of K. Now insert the point of the outlet tube K. into the liquid to be examined and by lowering the reservoir cause a vacuum so as to suck the liquid into the tube. The ether is introduced in exactly the same way. Now close the stopcock and run all the mercury or nearly all out of the tube and clamp the pressure tubing at H., and also shut the stopcock B. The tube and contents may be now violently shaken. After standing, the ether separates in a defined layer. The stopcock and clamp are now opened by raising the reservoir. The ether is made even to the last drop to flow out of K. into the tared flask from whence it is recovered by distillation.

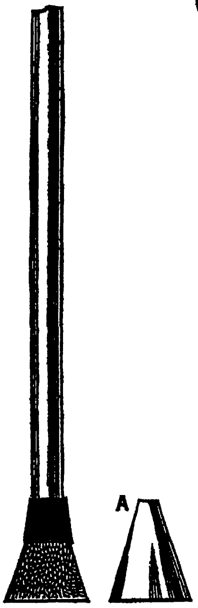

FIG. 2.

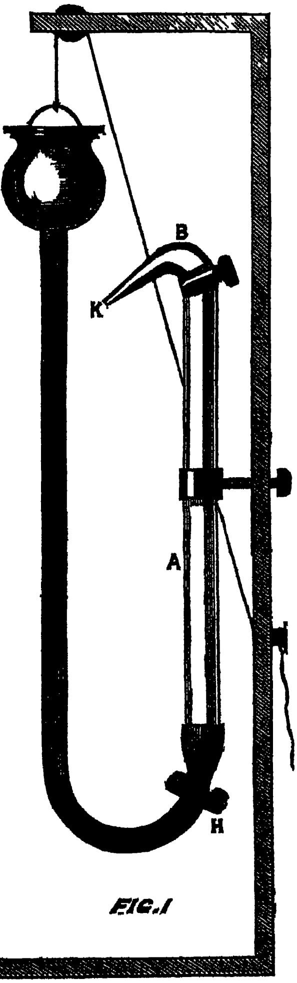

FIG. 1

Wines and tinctures freed from most of their spirit in this way were exhausted of quinine very rapidly by three times shaking up with ether, previously making the liquids strongly alkaline by soda. At first, a wooliness at the junction of the ether and the wine gave much trouble, but it was found that by using a large excess of soda the line between the liquid and the ether became sharp and well defined. Quinine is practically quite insoluble in strong soda lye.

I therefore declare that this method in my experience is, all things considered, the best for quinine estimations, but the others may be used as confirmatory checks.

THE PRINCIPLES OF HOP-ANALYSIS.

By Dr. G. O. Cech.*

Hop flowers contain a great variety of different substances susceptible of extraction with ether, alcohol and water, and distinguishable from one another by tests of a more or less complex character. The substances are:—Ethereal oil, chlorophyll, hop-tannin, phlobaphen, a wax-like substance, the sulphate ammoniate, phosphate, citrate and malates of potash, arabine, a crystallized white and an amorphous brown resin, and a bitter principle. That the characteristic action of the hops is due to such of these constituents only as are of an organic nature is easy to understand; but up to the present we are in ignorance whether it is upon the oil, the wax, the resin, the tannin, the phlobaphen or the bitter principle individually, or upon them all collectively, that the effect of the hops in brewing depends.

It is the rule to judge the strength and goodness of hops by the amount of farina—the so-called lupuline; and as this contains the major portion of the active constituents of the hop, there is no doubt that approximately the amount of lupuline is a useful quantitative test. But here we are confronted by the question whether the lupuline is to be regarded as containing *all* that is of any value in the hops and the leaves, the organic principles in which pass undetected under such a test, as supererogatory for brewers' purposes? Practical experience negatives any such conclusion. Consequently, we are justified in assuming that the concurrent development and the presence of the several organic principles—the oil, the wax, the bitter, the tannin, the phlobaphen, in the choicer sorts—are subject, within certain limits, to variations depending on skilled culture and careful drying, and that the aggregate of these principles has a certain attainable maximum in the finer sorts, under the most favourable conditions of culture, and another lower maximum in less perfectly cultivated and wild sorts. The difference in the proportion of active organic substance in each sort must be determined by analysis. There then remains to be discovered which of the aforesaid substances plays the leading role in brewing, and also whether the presence of chlorophyll and inorganic salts in the hop-extract influences or alters the results?

That in brewing hops cannot be replaced by lupuline alone, even when the latter is employed in relatively large quantities, is well known, as also that a considerable portion of the bitter principle of the hop is found in the floral leaves. Neither can the lupuline be regarded as the only active beer agent, as both the hop-tannin and the hop-resin serve to precipitate the albuminous matter, and clarify and preserve the beer.

Both chemists and brewers would gladly welcome some method of testing hops, which should be expeditious, and afford reliable results in practical hands. To accomplish this account must be taken of all the active organic constituents of the hops, which can be extracted either with ether, alcohol, or water containing soda (for the conversion of the hop tannin in phlobaphen).* It should further be ascertained whether the chlorophyll percentage in the hop bells, new and old, is or is not the same in cultivated and in wild hops, and whether the aggregate percentages of organic constituent observe the same limits.

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* "Zeitschrift fur Analyt. Chemie.," 1881.

As wild hops nowadays are frequently introduced in brewing, the proportion of chlorophyll and organic and inorganic constituents in them should be compared with those of cultivated sorts, taking the best Bavarian or Bohemian hops as the standard of measurement. The chlorophyll is of minor importance, as it has little effect on the general results.

By a series of comparative analysis of cultivated and wild hops, in which I would lay especial stress on parity of conditions in regard of age and vegetation, the extreme limits of variation of which their active organic principles are susceptible could be determined.

There is every reason to suppose that the chlorophyll and inorganic constituents do not differ materially in the most widely different sorts of hops. The more important differences lie in the proportions of hop resin and tannin. When this is decided, the proportion of tannin or phlobaphen in the hop extract or the beer can be determined by analysis in the ordinary way. But whenever some quick and sure hop test shall have been found, *appearance and aroma* will still be most important factors in any estimate of the value of hops. Here a question arises as to whether hops from a warm or even a steppe climate, like that of South Russia, contain the same proportion of ethereal oil—that is, of aroma—as those from a cooler climate, like Bavaria and Bohemia, or, like certain other fruit species of southern growth, they are early in maturing, prolific, large in size, and abounding in farina, but *deficient in aroma.*

The bearings of certain experimental data on this point I reserve for consideration upon a future occasion.

ANALYSIS OF FOOD AND DRUGS IN NEW YORK.

The Sanitary Committee of the New York State Board of Health, at a recent meeting in this city, discussed chapter 407 of the Laws of 1881, entitled "An Act to prevent the adulteration of food and drugs." The articles which come under the provisions of the Act were divided into eleven groups, each group being assigned to an Analyst, as follows :—

Group No. 1—Fruit and Spices; Dr. Lattimore, of Rochester.

Group No. 2—Sugar, glucose, syrups, molasses, confections, honey, soda-water, ice-cream; Dr. Pitt, of Buffalo.

Group No. 3—Butter, cheese, lard oil, olive oil; Dr. Caldwell, of Ithaca.

Group No. 4—Wine, beer, spirits, cordials; Dr. Englehart, of Syracuse.

Group No. 5—Tea, coffee and cocoa; Drs. Lattimore and Hoffman.

Group No. 6—Organic chemicals as met with in Pharmacy, quinine, and its preparations, ether, food essences; Dr. Caldwell.

Group No. 7—Meat extracts, fish and fish extracts, and gelatine; Dr. Chester, of Hamilton.

Group No. 8—Vegetable and animal drugs; Dr. Hoffman.

Group No. 9—All pharmaceutical preparations; Dr. Hoffman.

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* See C. Etti. in "Dingler's Polytech. Journ.," 1878, p. 354.

Group No. 10—Cereals, grain products, artificial cereals for the use of children and invalids, baking powders, and all chemicals used by bakers; Dr. Love, of New York.

Group No. 11—Milk and its preparations; Prof. Chandler.

The following were appointed inspectors to collect samples for analysis; Dr. G. D. Smith, of Fulton county; Dr. A. L. Colby, of New York, and Dr. C. E. Munsel, of New York.

ADULTERATION ACT FOR NEW YORK.

The following is the text of the new law, which has just been passed by the State of New York Legislature:—

AN ACT to prevent the adulteration of food or drugs.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:—

Section 1.—No person shall, within this State, manufacture, have, offer for sale, or sell any article of food or drugs which is adulterated within the meaning of this Act, and any person violating this provision shall be deemed guilty of a misdemeanour, and upon conviction thereof, shall be punished by fine not exceeding fifty dollars for the first offence, and not exceeding one hundred dollars for each subsequent offence.

Section 2.—The term "food," as used in this Act, shall include every article used for food or drink by man. The term "drug," as used in this Act, shall include all medicines for internal and external use.

Section 3.—An article shall be deemed to be adulterated within the meaning of this Act.

(*a*.)—In the case of drugs—

1. If when sold under or by a name recognized in the United States Pharmacopœia, it differs from the standard of strength, quality, or purity laid down therein.

2. If, when sold under or by a name not recognized in the United States Pharmacopœia, but which is found in some other Pharmacopœia or other standard work on Materia Medica, it differs materially from the standard of strength, quality, or purity laid down in such work.

3. If its strength or purity fall below the professed standard under which it is sold.

(*b*.) In the case of food or drink—

1. If any substance or substances has or have been mixed with it so as to reduce or lower or injuriously affect its quality or strength.

2. If any inferior or cheaper substance or substances have been substituted wholly or in part for the article.

3. If any valuable constituent of the article has been wholly or in part abstracted.

4. If it be an imitation of, or be sold under the name of, another article.

5. If it consists wholly or in part of a diseased or decomposed, or putrid or rotten, animal or vegetable substance, whether manufactured or not, or, in the case of milk, if it is the produce of a diseased animal.

6. If it be coloured, or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value.

7. If it contain any added poisonous ingredient, or any ingredient which may render such an article injurious the health of a person consuming it: Provided, that the State board of health may, with the approval of the governor, from time to time declare certain articles or preparations to be exempt from the provisions of this Act: And provided further, that the provisions of this Act shall not apply to mixtures or compounds recognized as ordinary articles of food, provided that the same are not injurious to health and that the articles are distinctly labelled as a mixture, stating the components of the mixture.

Section 4.—It shall be the duty of the State board of health to prepare and publish from time to time, lists of the articles, mixtures or compounds declared to be exempt from the provisions of this Act in accordance with the preceding section. The State board of health shall also from time to time fix the limits of variability permissible in any article of food or drug, or compound, the standard of which is not established by any national Pharmacopœia.

Section 5.—The State board of health shall take cognizance of the interests of the public health as it relates to the sale of food and drugs, and the adulteration of the same, and make all necessary investigations and inquiries relating thereto. It shall also have the supervision of the appointment of Public

Analysts and Chemists, and upon its recommendation, whenever it shall deem such officers incompetent, the appointment of any and every such officer shall be revoked and be held to be void and of no effect. Within thirty days after the passage of this Act, the State board of health shall meet and adopt such measures as may seem necessary to facilitate the enforcement of this Act, and prepare rules and regulations with regard to the proper methods of collecting and examining articles of food or drugs, and for the appointment of the necessary inspectors and analysts; and the State board of health shall be authorised to expend, in addition to all sums already appropriated for said board, an amount not exceeding ten thousand dollars for the purpose of carrying out the provisions of this Act. And the sum of ten thousand dollars is hereby appropriated out of the moneys in the treasury, not otherwise appropriated, for the purposes in this section provided.

Section 6.—Every person selling or offering or exposing any article of food or drugs for sale, or delivering any article to purchasers, shall be bound to serve or supply any Public Analyst or other agent of the State or local board of health appointed under this Act, who shall apply to him for that purpose, and on his tendering the value of the same, with a sample sufficient for the purpose of analysis of any article which is included in this Act, and which is in the possession of the person selling, under a penalty not exceeding fifty dollars for a first offence, and one hundred dollars for a second and subsequent offences.

Section 7.—Any violation of the provisions of this Act shall be treated and punished as a misdemeanour; and whoever shall impede, obstruct, hinder, or otherwise prevent any Analyst, Inspector, or prosecuting officer in the performance of his duty shall be guilty of a misdemeanour, and shall be liable to indictment and punishment therefore.

Section 8.—Any acts or parts of acts inconsistent with the provisions of this Act are hereby repealed.

Section 9.—All the regulations and declarations of the State board of health made under this Act, from time to time, and promulgated, shall be printed in the statutes at large.

Section 10.—This Act shall take effect at the expiration of ninety days after it shall become law.

BUTTER SUBSTITUTES.

Discussing the subject of dairy-farming, with special reference to the manufacture of adulterated products, an agricultural contemporary says:—Dr. Lyon Playfair's speech on this subject in the House of Commons, on April 1st this year, will not soon be forgotten. The gist of it was to the effect that if wholesome substitutes could be found for butter and cheese, at a lower cost than the real articles, the public would have no reason to complain, and British producers would have to protect themselves by making their products better and at a lower cost. He said: "If we could extract butter fats economically from vegetable oils, and give a sound, healthy butter from them at a cheap rate, it would be a matter of indifference to the public whether the butter came from the cow or from the vegetable." This view of the case may be theoretically correct, but practically it matters a great deal to the consumer whether he pays for butter substitutes at genuine butter price. Again, with regard to cheese, he says:—"Of the cheese principle in milk, there is only 4 lbs. to the 100 lbs. of milk, while in beans and peas there are 20 lbs. to the 100 lbs. Cheeses are made from peas in China, and are exposed for sale in the markets of that country, where they are esteemed by the people; but to our palates they are insipid, because they do not contain butter fats. I look forward to the day when cheeses will be made from beans, peas, and lentils, and after being mixed with good oleo-margarine, may form palatable and very economical cheeses." Oleo-margarine is beyond question a very wholesome and useful article of diet, when it is prepared from clean and sweet fats, and there can be no possible objection raised to its sale as oleo-margarine. But, as a matter of fact, it is sold only as an admixture with genuine butter, the admixture—whether of the highest or lowest grade—being invariably sold as butter. *This is the only fraudulent part of the business, and the only genuine cause of complaint which the British dairy farmer has with regard to the matter.* If consumers ask for butter made from cream, they should be able to obtain it, or if only an adulterated butter is obtainable, they ought to be informed of the real nature of the article they are purchasing. Dr. Playfair may have a theoretical liking for oleo-margarine butter and leguminous cheese, but he would probably have a very practical objection to purchase these articles as genuine dairy products at the full market price of the real articles. British dairying industry requires to be protected from fraud, and it would then have no cause to fear free trade in oleo-margarine or pulse cheese. A law should be passed which would render it impossible for butters which contain foreign admixture to be sold as genuine butters. There is at present no such law, for it is well known that some of the most saleable butters in our large towns are foreign manufactures, containing a large proportion of oleo-margarine. British dairy farmers cannot contend against this sort of competition, because the adulterated article is of very superior "make," and is sold in a very handy and attractive form, with a large profit, at rates which are considerably lower than those for which the genuine article can be produced. The only legal protection which British dairying interests need is protection from fraud. At the present time Continental countries are importing oleo-margarine on a very large scale from the United States and even from London, and the well-made, attractively-packed butter from these same countries meets a sale which is practically driving all but the very best of genuine home products out of the market. This would be fair, if the competing terms were equal; but they are not equal, because all these foreign adulterated articles are sold as butter. If they were sold as admixtures, consumers could pay their money and take their choice; as it is, they pay their money for what seems to be the best. Possibly it may be the best, *ad valorem*, but there are many who would not purchase adulterated butter at any price if they knew it to be adulterated. The fraudulent sale of adulterated dairy products should be adequately prevented by legal enactment, and then the action of consumers would settle the trade on a firm and definite basis.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of the public water supplies from January to June, and the valuations for last month (the July waters) and this month (the August waters).

	Average to June.	July.	August.
LONDON—			
Kent	30	27	20
New River	26	17	17
East London	32	39	20
Southwark and Vauxhall	34	28	31
West Middlesex	30	24	29
Grand Junction	30	23	25
Lambeth	37	29	31
Chelsea	30	26	32
Bath	12	19	20
Birmingham	33	37	26
Bolton	..	17	19
Bradford	53	53	59
Brighton	24	23	25
Bristol	22	27	..
Bury	..	35	24
Cambridge	28	26	22
Canterbury	17	22	16
Coventry	33	..	..
Croydon	27	30	..
Darlington	33	39	96
Derby	18	13	..
Droitwich	39	..	..
Dublin	23	..	13
Dudley	45	..	..
Edinburgh	28	21	20
Exeter	20	16	23
Grantham	27	..	32
Hastings	..	20	25
Huddersfield	23	26	28
Hull	23	..	..
Ipswich	27	30	30
King's Lynn	94	110	48
Leamington	26	..	26
Leeds	35	28	22
Leicester	42	24	26
Liverpool	36	29	41
Llandrindod	13	..	..
Maidstone Water Company	39	34	30
,, Public Conduit	36	28	25
Manchester	22	17	29
Newark	39	46	41
Newcastle-on-Tyne	37	40	13
Northampton	44	..	..
Norwich	36	49	58
Nottingham	39	46	38
Oldham	23	..	..
Plymouth	29	..	..
Portsmouth	30	22	26
Reading	25	20	34
Rochdale	9	7	9
Rugby	41	..	..
Salford	18	14	21
Sevenoaks	20	..	..
Sheffield	22	..	..
Shrewsbury	23	..	17
Southampton	43	..	40
Stockport	17	..	..
Stourbridge	37	..	..
Stourport	37	..	..
Sunderland	25	27	..
Swansea	16	14	19
Warwick	34	34	..
Whitehaven	9	17	14
Wolverhampton	40	39	32
Worcester	55	..	..

Taking the Metropolitan waters we find that the average valuation of the eight supplies for August is about one less than that for July.

The Kent and East London each show an improvement; the New River remains the same as last month; and in five cases there is a slight increase in the figure, although in every case but one the August figure is below the average for the first six months of the year.

The most pure of the provincial supplies during August are: Rochdale with a value of 9; Dublin, 13; Whitehaven, 14; Canterbury, 16; Shrewsbury, 17; Bolton and Swansea, each 19; and Edinburgh and Bath, each 20—and in nearly all cases these figures show a slight improvement upon the July waters.

The following supplies also show an improvement on the July supplies, viz.:—Birmingham, Bury, Cambridge, King's Lynn, Leeds, Maidstone, Southampton, and Wolverhampton.

On the other hand, in the following towns, the valuation shows increased impurity, viz.:—Bath, Bradford, Bolton, Darlington, Exeter, Grantham, Hastings, Huddersfield, Ipswich, Liverpool, Manchester, Newark, Newcastle, Norwich, Reading, Swansea.

ERRATA.—In the corresponding paper to this in our last issue the average valuation of the Chelsea water for the first six months was, by a printer's error, inserted as 39 instead of 30.

ANALYSTS' REPORTS.

Dr. J. F. Hodges, analyst for Belfast, reports that during the past quarter 54 articles of food, &c., were examined by him, viz.:—32 samples of sweetmilk, 14 of buttermilk, and 8 of aerated waters. Of these three samples of sweetmilk and seven samples of buttermilk were found adulterated; and fines were inflicted during the quarter, amounting to £9 10s. 8d., for violations of the Act.

At Somerset Quarter Session, held at Taunton, the county analyst, Dr. H. J. Alford, reported that during the past quarter he had analysed 255 samples, all of which, except one from the general public, were brought by the police inspectors. The samples included 86 of butter, five of which were adulterated; but in no case was the adulteration such as to be be prejudicial to health. The Chairman (Mr. R. H. Paget, M.P.) said in some cases there had been a failure of justice, owing to the analyst's certificate not having been given in proper form, according to the statute, and by his directions the Clerk of the Peace had communicated with the analyst on the subject. The Chief Constable had issued a circular in consequence of the suggestion made at the last quarter session, calling the attention of the superintendents of the police to the large importation of oleo-margarine, butterine, and other compounds passed off as butter. Mr. Rogers asked if the report of the analyst stated what the butter was adulterated with. The Clerk of the Peace said foreign fat. The Chairman observed that foreign fat was invariably of an inferior quality, and care should be taken to protect the interests of the public.

Dr. Alfred Hill, analyst for the Borough of Birmingham, reports that during the past quarter he examined 43 samples, viz.:—15 of milk, 12 of tea, 6 of ale, 6 of flour, and 4 of butter. Nine of the milks had been tampered with, but the other samples were unadulterated. One milk had been deprived of 50 per cent. of its cream, and a fine of £10 and costs was inflicted on the vendor.

THE ANALYSIS OF PUBLIC WATER SUPPLIES.—During the past month we have forwarded to the Analysts who are engaged in this scheme a copy of the Tables of Water Analysis, the Instructions for Water Analysis, and other matter connected with the subject. In deference to the wishes of those engaged in the analyses, we have, as our present stock is exhausted, decided to print at once a further supply for publication.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in August, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two foot Tube.	Smell when heated to 100° 1 aln.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Aug. 10	clear, green blue	none	1·35	trace	·350	none	·0022	none	none	15·0°	4·3°	24·80	few fibres	Wigner & Harland.
New River	„ 15	clear	none	1·17	trace	·137	·0007	·0006	·0030	·0210	18·7°	3·4°	18·48	satisfactory	B. Dyer.
East London ..	„ 4	yellow green	none	1·34	trace	·130	·0013	·0021	none	·0074	13·5°	3·0°	18·60	veg. debris fibres	Wigner & Harland.
Southwark & Vauxhall ..	„ 6	c. v. f. yellow	none	1·24	trace	·110	·0013	·0070	·0028	·0502	13·5°	4·0°	19·60	satisfactory	J. Muter.
West Middlesex	„ 17	greenish yellow	none	1·17	none	·088	·0006	·0037	·0250	·0490	12·0°	2·4°	17·36	veg. debris & monads.	O. Hehner.
Grand Junction	„	pale yellow	none	1·06	trace	·092	·0002	·0059	·0012	·0631	12·3°	3·0°	17·80		A. Wynter-Blyth.
Lambeth	„ 11	c. v. f. yellow	none	1·24	trace	·110	·0014	·0070	·0028	·0476	14·5°	4·0°	19·60	satisfactory	J. Muter.
Chelsea	„ 9	c. p. grn. yelw.	none	1·12	trace	·190	none	·0030	·0200	·0560	12·0°	3·0°	16·80		A. Dupré.
Bath	Aug. 10	c. f. blue	none	·96	none	·160	none	·0008	none	none	16·0°	4·0°	22·80	algæ & diatoms	J. W. Gatehouse.
Birmingham ..	„ 2	s. turb. grn. ylw.	none	1·47	traces	·169	·0020		·0050	·0490	10·8°	6·7°	18·24		A. Hill.
Bolton........	„ 1	v. turbid	none	·47	none	·032	·0012	·0050	·0030	·0220	3·3°	3·3°	7·64	mineral mttr. & veg. deb.	W. H. Watson.
Bradford	„ 5	s. yelw. v. opqe.	none	·70	none	none	·0007	·0056	·0520	·2300	3·3°	3·0°	6·50	none	F. M. Rimmington.
Brighton	„ 9	c. blue green	none	1·84	trace	·318	·0031	·0049	none	none	12·0°	4·1°	21·00	vegetable debris	Wigner & Harland.
Bury (Lan.) ..	„ 9	s. yellow turbid	none	·55	none	·042	·0040	·0095	·0052	·0120	4·9°	4·6°	8·08	mineral mttr. & veg. deb.	W. H. Watson.
Cambridge	„ 15	c. pale blue	none	1·40	traces	·460	·0007	·0020	none	·0157	14·5°	8·5°	23·10	satisfactory	J. West-Knights.
Canterbury	„ 20	c. pale blue	none	1·47	none	·375	·0005	·0007	·0050	·0190	5·9°	4·1°	11·48	slight carb. of lime	S. Harvey.
Darlington	„ 15	c. brwnsh. yelw.	peaty	·50	trace	·002	trace	·0063	·0224	·3766	5·6°	5·3°	8·40	diatoms vegetable debris	W. F. K. Stock.
Dublin........	July 30	almst. colourless	none	·82	trace	trace	·0005	·0040		·0100	1·2°	0·6°	3·56	diatoms, &c.	C. A. Cameron.
Edinburgh	Aug. 16	s. brown	none	·72	none	traces	·0016	·0072	·0128	·1024	5·2°	4·2°	5·60	none	J. Falconer King.
Exeter	„ 9	f. grnsh. yellow	none	·84	trace	·201	·0023	·0028		·0579	2·9°	2·9°	7·00		F. P. Perkins.
Grantham	„ 10	grnsh. s. turbid	none	1·05	trace	·432	·0007	·0043	none	·0316	13·5°	3·5°	20·72	diatoms	A. Ashby.
Hastings	„ 10	slightly milky	none	4·70	trace	·120	none	·0040	none	·0020	6·5°	3·5°	20·30	none	H. Cheshire.
Huddersfield ..	„ 14	c. f. yelw. green	none	·55	none	·012	none	·0056	·0408	·0856	2·2°	2·0°	5·60	satisfactory	G. Jarmain.
Ipswich	„ 13	c. colourless	none	2·50	trace	·363	·0032	·0040	none	·0072	24·0°	4·8°	34·75	satisfactory	J. Napier.
King's Lynn ..	„ 8	yellow green	weedy	1·39	h. traces	·420	·0020	·0049	·0134	·0348	10·0°	3·5°	15·94	veg. debris diatoms moving organisms	W. Johnstone.
Leamington ..	„ 11	c. greenish	none	1·17	none	none	·0014	·0110	none	·0023	26·1°	19·8°	30·50	none	A. Bostock Hill.

SOCIETY OF PUBLIC ANALYSTS.

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									15 mins at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leeds	Aug. 12	light yellow	none	·62	none	none	none	·0028	·0084	·0515	3·4°	2·8°	4·48	peaty matter	T. Fairley.
Leicester......	„ 19	v. s. yellow	none	1·13	trace	·115	·0012	·0030	·0025	·0740	8·0°	4·7°	16·20	satisfactory	W. L. Emmerson.
Liverpool	„ 17	yellow green	s. peaty	1·08	traces	·067	·0021	·0070	·0560	·0920	4·8°	4·6°	9·10		A. Smetham.
Maidstone—															
Wtr. Company	„ 12	lgt. grn. s. opqe.	none	2·70	traces	·280	none	·0018	·0028	·0271	19·5°	7·2°	32·79	none	M. A. Adams.
Public Conduit	„ 12	c. light blue	none	2·30	traces	·350	none	·0007	·0028	·0109	18·6°	7·2°	33·32	none	M. A. Adams.
Manchester....	„ 12	c. colourless	none	·74	none	none	·0035	·0051	·0340	·1099	1·8°	1·8°	4·91	none	W. Thomson.
Newark	„ 9	bluish green	none	1·78	trace	·037	·0009	·0043	none	·0989	17·0°	8·5°	35·00	diatoms and desmids	A. Ashby.
Newcastle-on-Tyne......	„ 8	f. yellow	none	·76	trace	·044	·0010	·0110	·0060	·1300	11·8°	4·9°	15·40	satisfactory	J. Pattinson.
Norwich	„ 9	s. grnsh. yellow	none	2·20	traces	·059	traces	·0070	·0386	·0400	15·0°	5·0°	16·40	satisfactory	W. G. Crook.
Nottingham ..	„ 22	c. green. bluish	none	2·10	traces	1·250	none	·0005	none	·0100	15·0°	8·0°	29·80	veg. deb. & fibres animal.	Wigner & Harland.
Portsmouth ..	„ 14	clear	none	1·17	traces	·419	traces	·0021	none	none	11·5°	2·0°	18·70	decomp. veg. deb. diams.	W. J. Sykes.
Reading	„ 11	yellowish	none	1·00	trace	·144	·0014	·0063	·0040	·0560	14·8°	3·8°	21·75	vegetable debris	J. Shea.
Rochdale	„ 17	pale blue	none	·50	none	·010	·0030	·0036	none	·0005	2·5°	2·0°	4·20	satisfactory	T. A. Collinge.
Salford	„ 3	cloudy & yellow	none	·70	none	none	·0035	·0014	·0110	·0670	3·5°	3·0°	4·00	none	J. Carter Bell.
Shrewsbury ..	July 26	c. colourless	none	1·45		·300	·0010	·0015	none	none	22·0°	3·8°	26·00	none	T. P. Blunt.
Southampton ..	Aug. 18	yellowish	none	·98	trace	·476	·0033	·0043	·0096	·0980	12·3°	4·5°	19·40	vegetable debris	A. Angell.
Swansea	„ 19	s. turbid	none	1·10	trace	none	·0010	·0063	·0040	·0040	3·0°	2·5°	4·90	earthy matter	W. Morgan.
Whitehaven ..	„ 4	v. s. turb. p. grn.	none	·36	none	·009	none	·0017	none	·0151	·4°	·4°	2·07	veg. deb. diams. desmids	A. Kitchin.
Wolverhampton	„ 13	s. yelw. tinge	none	1·29	trace	·065	none	·0042	·0013	·0448	13·7°	5·5°	21·42	veg. deb. spores diatoms	E. W. T. Jones.

Abbreviations.—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

SCHUYLKILL WATER.

To the Editor of "The Analyst."

Sir,—I send the following as a result of analysis of a sample taken from laboratory hydrant, July 19th :—

Smell at 100° F.	Slightly musty.
Chlorine	0·39 grns. per gall.
Saline Ammonia	0·0014 ,,
Albuminoid Ammonia	0·0084 ,,
Oxygen absorbed in two minutes	None. ,,
,, ,, ,, four hours	0·0630 ,,
Hardness before boiling	6·0°
,, after ,,	5·5°
Total solids	8·41 ,,
Sediment	None; water clear and colourless.

The increase of the various ingredients is due probably to the want of rain, and consequent diminished volume of water in the river.

Yours,

HENRY LEFFMAN, M.D.

715, *Walnut Street, Philadelphia, July 30th*, 1881.

WATER ANALYSIS IN NEW YORK.

To the Editor of "The Analyst."

Sir,—I have been much interested in the Papers on Water Supplies which have recently appeared in The Analyst, and the Directions of the Committee of the Society of Public Analysts.

My method of making ammonia and albuminoid ammonia determinations may not be acceptable, but I find it more convenient. I first put some 300 c.c. of water in the retort, with 25 c.c. carbonate of soda solution and distil until no more ammonia appears in the distillate, to clean retort, &c., then add the water 500 c.c., distil and nesslerize the distillate, and then, if I have more than one sample to test, add 500 c.c. and nesslerize again. Then, if the retort is not too full, add 50 to 80 c.c. permanganate solution, and distil until the distillate is free from ammonia; then add 500 c.c. more water and distil, and nesslerize the distillate which gives total. The difference between free and total would be albuminoid ammonia.

The method is, as you see, adopted from suggestions thrown out in various English publications on the subject, and when I have two or three waters at a time to test, it effects a great saving of time, and avoids any corrections for ammonia in the reagents, which I find is very common. I get results agreeing with themselves on the same sample much more readily than in any other way.

I should be glad to hear criticisms on the method.

As regards chlorine, if a water shows nothing high but that, it would take a sample almost impalatable to condemn it on that ground alone, though without very excessive amounts of other constituents, it might be reckoned as doubtful on account of the presence of some really innocent chlorides.

Yours, &c.,

School of Mines, New York. E. WALLER.

LAW REPORTS.

Adulterated Butter.—A Nice Question:—

Hamilton T. Hardman, provision merchant, at Sunderland, and the occupier of a stall in the Market, was charged by William McKay, inspector of nuisances to the Corporation, with selling butter adulterated to the extent of 76 per cent. with foreign fats, on the 30th June. Mr. F. M. Bowey, Deputy Town Clerk, appeared in support of the charge, and Mr. Marshall defended. The Inspector proved buying the article as butter, and a certificate from Dr. Yeld, the borough analyst, stated that it was adulterated to the extent named. Mr. Marshall said he had an objection to the summons to raise. The alleged offence was committed at noon on the 30th June, and the summons was not served until the evening of the 28th July. He contended that as more than 28 days, allowed by law, had elapsed, the summons must break down. Mr. Bowey, in reply, said if the summons had not been served within 28 days, as regarded the hours, it had been legally served as regarding the days themselves. The Bench overruled the objection. Mr. Marshall said his defence to the charge was that the defendant's son, a little boy, who had perhaps somewhat carelessly been left in charge of the stall, had inadvertently sold butterine for butter, and even though an offence might thus have been committed, he asked the Bench to deal leniently with the defendant. The Bench considered the case proved, and fined the defendant 5s. and costs, a distress warrant to be issued in default.

A Mistaken Applicant:—

A poor woman came before the magistrate at the Lambeth Police Court and stated that she purchased some flour at a shop in order to have it analysed, as she had had some from the same place which she thought was adulterated. By the direction of Mr. Long, the inspector to the Newington Vestry, she took the flour to him, and he forwarded it to Dr. Muter, the analyst. She was afterwards given a printed certificate, and called upon, much to her surprise, to pay 10s. 6d. for it. The certificate stated that the flour had been received from Mr. Long for the purpose of being analysed. She was a poor woman, and thought it very hard she should have to pay.—Mr. Ellison said he had no power to interfere, but would, however, direct Sergeant Underwood to see the vestry clerk of Newington upon the matter.

In reference to above, Mr. Long, the sanitary inspector of St. Mary, Newington, afterwards appeared before the court. He said the woman had stated that she purchased some flour, believing it to be adulterated, and by the advice of Mr. Long had it examined by the Public Analyst, and that afterwards she was called upon to pay 10s. 6d., the fee of the analyst. Mr. Long, in explanation, informed Mr. Ellison, the Magistrate, that the woman was distinctly told by him that she would have to bear the cost of the analysis, and she expressed her willingness to do so: he therefore forwarded the sample to the Public Analyst. Mr. Ellison said he had informed the applicant he had no power to interfere, and after the explanation of Mr. Long, there was an end of the matter. Mr. Long hoped the same publicity would be given to the explanation as to the application.

Quinine Wine.—What is a Wine Glass?

George Trenchard Cox, grocer, of 1 and 2, Thayer Street, Manchester Square, appeared in answer to a summons taken out against him by the Marylebone Vestry through George Windle, inspector of nuisances, for selling a bottle of quinine wine not containing, as stated on the bottle, "one grain of sulphate of quinine in each wine-glassful." The analyst for Marylebone, Dr. Wynter Blyth, gave a certificate that in his opinion the wine contained three-fifths of a grain instead of a grain of sulphate of quinine in every two ounces. For the defence, it was urged that quinine wine was not a drug, but a beverage, and a license was required for its sale. The wine-glass, too, referred to was not such a one as was used in a chemist's laboratory, but such as was in common use. Dr. Attwell was called, and said he had tried the capacity of a large number of glasses, and found them to be from 2¾ ounces to 3½ ounces. The average of 20 glasses was 3 ounces. They were sherry glasses, and port glasses held 3¾ ounces. This quinine contained one grain of sulphate of quinine in each wine-glassful. Mr. De Rutzen said the whole question to be decided was, What was a wine-glass? Was it one used as a chemical measure or one in ordinary use? The analysts agreed that if it were the one in ordinary use there was a grain in it. Under the circumstances, he should dismiss the summons.

The Sale of Lime-water.—Richards *v.* Manfull:—

At the Guildhall, Nottingham, on August 3, Horatio John Manfull, of 88, Arkwright Street, Nottingham, chemist, was charged before Mr. Blain (in the chair) and Mr. F. W. Parsons that he did, on June 29 last, at Arkwright Street, Nottingham, unlawfully sell to one William Richards, chief inspector of nuisances, a certain drug, to wit, one pint of lime-water, which was not of the nature, substance, and quality of the drug or article demanded by the said William Richards. Mr. S. G. Johnson, town clerk, prosecuted on behalf of the Corporation, and Mr. Henry Glaisyer, solicitor, of Birmingham, represented the defendant. In opening the case, Mr. Johnson said there were three summonses returnable on that day against three chemists in the town for selling lime-water contrary to the 6th section of the Sale of Food and Drugs Act. He understood that two of them were not represented by professional men, but that the third was represented by his friend Mr. Glaisyer, therefore, with the permission of the Bench, he would take Mr. Manfull's case first. He might tell the Bench that they had recently had a great deal of infantile diarrhœa in the town, and the attention of Mr. Seaton, the medical officer of health, had been called to the matter. In that town there were, as the bench would be aware, a number of women who went out to work during the day, leaving their children at home in the care of others. Lime-water was frequently used mixed with milk for dietetic purposes for such children, and it was of course of the utmost importance that the lime-water so used, and also that the lime-water ordered by medical men in prescriptions, should be of the best quality and of full strength, otherwise the health of the district must suffer, as the preparation in question was continually prescribed for diarrhœa, more particularly for children. Mr. Manfull being asked for a pint of lime-water, he was bound to supply a preparation known to the medical profession by that name, that of the Pharmacopœia, that being the only preparation a person going to a chemist's shop and asking for lime-water would expect to receive. Mr. Manfull had not been dealt with exceptionally in this matter. Twelve chemists' shops were visited by the inspector on the day the purchase of the drug in question was made from the defendant, and twelve samples of lime-water were taken, nine of which were of the required strength. The required strength, as he understood it, was distilled water thoroughly saturated with lime. Having read the 6th section of the Act, Mr. Johnson proceeded to say that it must stand to common sense that if a person went into a chemist's shop and asked for a drug he expected to get a drug of the nature, substance, and quality of the article demanded, and if that person asked for lime-water he would expect to get lime-water of the full strength, namely distilled water saturated with lime. If he did not get a preparation of that strength he did not get *lime-water*, but simply lime *and* water. He did not get the article he demanded, and he was prejudiced accordingly. In this particular case the Public Analyst had certified that the drug sold by the defendant was not lime-water, but lime and water, and did not contain more than about half the lime it should contain if of full strength, so that a medical man would be misled to the extent of half the lime in a prescription dispensed with the lime-water sold by the defendant. He should contend this point very strongly, because if it was contended for the defence that there was lime in the water sold, and that, consequently, the preparation sold was lime-water, he should call witnesses to show that there was a preparation known among chemists by that name, for which there was a well-recognised form of manufacture, which would produce a preparation of known strength, and that when a person asked for lime-water that preparation and no other should be sold, and that a person had a perfect right to expect to get that article, and was prejudiced if he did not get it of full strength. The matter was one of considerable public importance, and one which concerned the health of the whole district. He should call the medical officer of health, he should put in the analyst's certificate, and he should call the sanitary inspector and others. Mr. Glaisyer said, that with regard to the case in which he was instructed, he did not think there would be any necessity for his friend to go into the particulars of the case as sketched out, as he was prepared to acknowledge that the lime-water sold by the defendant did not contain the full proportion of lime, and he should only ask permission to address the Bench, and plead extenuating circumstances. Mr. Johnson said under the circumstances named by his friend, he did not think it necessary to go more fully into the merits of the case; he did not wish at all to make out a special case against Mr. Manfull. Mr. Glaisyer said the defendant, Mr. Manfull, had been in business in the town for eleven years, during which time he had carried on business in Arkwright Street, and that no charge of a similar nature to that they were now considering had ever been brought against him before with regard to the sale of any of his drugs. The inspector went to his shop and asked for lime-water, and he was supplied, as his friend opposite had told them, with an article which contained lime, but not lime in sufficient quantity to be that known to the medical profession and technically called lime-water. Now lime-water was made according to certain directions in the British Pharmacopœia, which ordered a certain quantity of lime to be put into a stoppered bottle containing a certain quantity of distilled water, and the ingredients to be shaken well for two or three minutes. "After 12 hours the excess of lime will have subsided, and the clear solution may be drawn off with a syphon as it is required for use, or transferred to a green glass bottle furnished with a well-ground stopper." He was told that each of these directions, the stoppered bottle, the shaking, the 12 hours' standing, the green glass bottle with the well-ground stopper, were all essential to the production of the proper article. Exposure to the air when shaken in a closed bottle would cause the lime which was in solution to be thrown down as a precipitate in the form of carbonate of lime, which would fall to the bottom of the vessel; and thus, of course, lessen the quantity of lime in the solution; therefore, even supposing the water were in the first instance saturated with lime, after exposure to the air a certain quantity of lime would be thrown out in the form of carbonate of lime. This would necessarily lessen the quantity of lime contained in solution in the fluid. The shaking which the British Pharmacopœia directed was necessary in order to extend or separate the particles of slaked lime, and thus allow free access of the water to every particle, in order that it might take up the required quantity of lime to form a solution of the proper strength. The 12 hours' standing was also necessary for the same purpose. It was not a case where the law had been wilfully infringed or any attempt made to fraudulently adulterate a drug for the sake of gain, the total price of this article being only a few pence, nor was it a case in which a tradesman had wilfully and fraudulently sold an inferior preparation with greater profit; it was simply an instance where sufficient care had not been exercised in attending to the uttermost letter of directions contained in the British Pharmacopœia. With these remarks he would leave the matter in the hands of the Bench, submitting that, under the circumstances, a nominal fine would meet the justice of the case. Mr. Parsons said that although to the chemist the quantity of lime contained in lime-water might not make a pennyworth of difference, as regards the health of a large and populous town containing upwards of 200,000 inhabitants it was a most serious matter. Mr. Blain said: The Bench think this a very important question. The public must be protected, and, as this is the first offence, Mr. Manfull will have to pay £5.

George Powell, chemist, St. Ann's Well Rd., was charged with a similar offence. The Town Clerk said this was a case which was on all fours with the last. The defendant pleaded guilty, and was also fined £5.

Mr. J. T. Rayson, chemist, 273, Great Alfred Street, was also summoned for selling lime-water which was not of sufficient strength. Defendant said he had only had the shop a month, and his predecessor guaranteed that the lime-water was right. It was really no neglect on his part. Dr. Seaton, in answer to the Bench, said the lime-water ought to have been made since then, but if it had been put in a stoppered bottle there was no reason why it should not keep good for an even longer time. Defendant was also ordered to pay a fine of £5.

TRICHINOSIS DUE TO EATING FLESH OF A WILD BOAR.

We condense the following account by Dr. John Wortabet, of St. John's Hospital at Beyrout, of an outbreak of trichinosis in Palestine, from the London *Lancet:*

A wild boar was killed in the jungle near the village of Khiam, last November, and the meat, half cooked, or raw, was eaten by the villagers. During the second week afterward, the persons who had eaten, became ill, and if any escaped at that date they suffered later; but of those who had abstained not one fell ill. The symptoms of the disease were the same in all the victims; but those who ate the flesh raw suffered most severely, and the children generally suffered less than adults. The head of the boar was sent as a present to a family some miles north of Khiam, who boiled it very thoroughly before eating it, and though a good number joined in the repast no one of them suffered in the least. Dr. Wortabet visited the village on January 1 and 2, and found 257 persons more or less ill,—namely, men 121, women 101, children 35. Five others—three men and two women—had died before his arrival. The period of incubation does not seem to have ever been under ten days, though it was prolonged in some cases to twenty. In one individual, who had eaten the meat fairly cooked, the disease did not appear before the end of the fourth week, and then it was so slight that he was not laid up by it. They were unanimous in saying that up to the date of the actual invasion of the disease, they felt as well as usual. He heard, however, of one man who had vomiting and diarrhœa soon after eating, probably the effect of an overloaded stomach, and that he was one of those who had suffered the least. The instances in which the disease appeared later than the second week were very few. Some ten years ago there was a similar outbreak from the same cause in a village a few miles to the east, when about twenty persons lost their lives. He was told, also, that the wild boar lives chiefly on the roots of the canes which are abundant in the marshes, and as he burrows the ground with his snout he snaps up small animals, such as worms, snakes, and wild rats—the latter of which are said to be sometimes infested with trichinæ spiralis. A somewhat aged woman, whom he had seen quite ill when he was there, died afterward, and he succeeded in obtaining a piece of muscle (biceps brachialis), which reveals under the microscope a good number of trichinæ, and sets at rest any question as to the nature of the disease.

The editor of the *Lancet* adds this note on the results of a microscopic examination of the muscle:

> "We received from Dr. W. a specimen of the muscle referred to in the postcript, and on microscopical examination found it to contain a large number of non-encysted embryo næmatoids. The isolated worms possessed the general shape, with terminal anus, met with in the embryos of trichinæ spiralis. They were too immature to admit of any details of organization being made out. They were found to be $\frac{1}{30}$ inch long by $\frac{1}{500}$ inch broad. The fact that they were non-encysted is in accordance with the other fact that they had not yet attained the usual size of encysted trichinæ."

J. Comyns Leach, M.D., B.Sc., F.C.S., has been appointed Analyst for the Borough of Shaftesbury.

The State of New Jersey has just passed an Act to prevent the Sale of Adulterated Food and Drugs, which, as well as the Act of the State of New York, contain the definition of adulterated articles as set out in the essay which obtained the prize offered by the National Board of Health already reprinted in this Journal.

We have received a copy of Messrs. Townson & Mercer's new catalogue. It is well illustrated, carefully sorted, and extremely complete. We think every analyst will find it advantageous to keep a copy of it for reference. Whether he uses it for purchasing by or not, he will certainly have a handy book at his side.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
4988	K. W. Hedges	Electric Lamps	6d.
5014	J. Swan	Electric Lamps	6d.
5081	C. D. Abel	Purification of Sugar Juices, &c.	4d.
5146	W. Weldon	Obtaining Products from Residue of Manufacture of Sulphuric Acid by Cupreous Pyrites	4d.
5180	J. A. Dixon	Preparation of Alkali Salts of Sulphuric Acids	4d.
5191	C. A. Burghardt	Treatment of Fats and Oils for Manufacture of Soap	6d.
5374	J. J. Knight	Treatment of Mineral Phosphates containing Alumina and Oxide of Iron	4d.
5389	A. M. Clark	Extracting Juices, &c., from Sugar Cane	6d.
5394	W. Weldon	Manufacture of Bicarbonate of Soda	4d.
5478	H. A. Dufrené	Manufacture of Ammonia	6d.
1881			
65	P. M. Justice	Electric Lighting	6d.
153	A. Muirhead and J. Hopkinson	Electric Lamps	6d.
184	E. P. Alexander	Manufacture of Carbonate of Potassium	4d.
197	W. R. Lake	Treatment of Saccharine Liquids, &c.	6d.
222	W. Weldon and W. G. Strype	Purifying Hydrochloric Acid	4d.
289	J. A. Dixon	Production of Benzol Diacetate	4d.
728	C. Pieper	Manufacturing Magnesia, &c.	4d.
736	A. Sauvre	Drying and Refining Sugar	4d.
2226	G. S. Dean	Preparation of Nitro-Glycerin Compounds	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; Analysis of Simpler Salts, by H. A. Phillips; Report of The People *v.* Schrumpf, New York; Butterine, Description of its Manufacture, by W. O. Westling; The Microscope (Detroit); Water and Air, their Relations to Health and Disease, by W. H. Watson; New Commercial Plants and Drugs, by T. Christy; Report on Croton Water, by Dr. E. Waller; Report on Stench Nuisances, by New York State Board of Health; The City Record of New York.

THE ANALYST

OCTOBER, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The Country Meeting of this Society was held on the 6th September at York, during the British Association Meeting. In the absence of the President, Dr. Wallace took the chair.

The ballot papers were opened by Mr. Jarmain and Mr. Baynes, and the following gentlemen were declared to be duly elected :—C. M. Blades, Analytical Chemist, Northwich; C. Girard, Public Analyst for Paris; C. T. Kingzett, F.C.S., F.I.C., Analytical Chemist, London.

The following gentleman was proposed for election:—W. J. R. Simpson, M.D., Aberdeen.

Mr. Allen read a paper "On the Relative Proportions of Olefines in Shale and Petroleum Products."

The Chairman, in addressing a few remarks to the meeting, congratulated the Society on the good work they had done during the past year in respect of the scheme they had published of water analysis; and while speaking of it with great eulogium, expressed a hope that the Society would continue some similar labours in a new direction. He thought it would be worth while if the Society were to consider as to some new subject to be recommended to the Council for reference to a committee, who should be requested to frame a new series of instructions which would be of assistance to Public Analysts.

It was suggested that a good subject would be the preparation of a catalogue of the re-agents, which ought to be found in the laboratory of a Public Analyst, the sources from whence they can be best procured, and if requisite the best modes of their manufacture, the tests for their purity, and methods of purification where requisite.

ON THE RELATIVE PROPORTIONS OF OLEFINES IN SHALE AND PETROLEUM PRODUCTS.

By Alfred A. Allen.

Read before the Society of Public Analysts, at York, on 6th Sept., 1881.

In a previous Paper I have shown that some of the commercial products obtained by the distillation of bituminous shale differ from the parallel series of products derived from petroleum. As far as the action of strong nitric and sulphuric acids is concerned, this difference is fully recognised by those familiar with the products in question, and has been rightly attributed to the different proportions of olefines contained in them. The method of treatment of the hydrocarbon with fuming nitric acid, fuming sulphuric acid, and caustic soda used successively, is practically a process for the estimation of the paraffins, the hydrocarbons of all other series being destroyed or converted into soluble products.

One of the best known and most characteristic properties of the olefines or hydrocarbons of the ethylene series is the readiness with which they enter into combination with bromine to form additive compounds of a stable and definite character. The paraffins, or hydrocarbons of the marsh gas series, on the other hand, do not form additive compounds with bromine, and are practically unaffected by it under the ordinary conditions of experiment.

Combination with bromine has long been used for assaying coal gas for the proportion of ethylene and allied hydrocarbons contained in it, and has been previously employed for the examination of shale-products. I have, however, been unable to learn the precise manner in which it has been used for the latter purpose. At first I met with considerable practical difficulty in applying it quantitatively, chiefly owing to the solubility of the excess of bromine in the brominated rendering it difficult to observe the end of the reaction. Hence it may be of interest to describe the plan which I ultimately adopted, and by which such numerical results as I shall lay before you have been obtained.

A solution of hypobromite of sodium is prepared by measuring out 40 c.c. of bromine, gradually adding solution of caustic soda (avoiding any rise of temperature) till the liquid is slightly alkaline and of a light yellow colour, and then diluting the liquid with water to 1 litre. The strength of this solution is then ascertained by measuring out 20 c.c., diluting with about 150 c.c. of water, in a porcelain dish, adding a strong solution of pure iodide of potassium, and then acidulating the mixture with hydrochloric acid. The iodine set free is then titrated with decinormal solution of sodium thiosulphate (hyposulphite, 24·8 grammes of crystallized $Na_2S_2O_3$ per litre).[*]

Five grammes or 5 c.c. of the sample of mixed hydrocarbons to be tested is next placed in a small tapped separator, or Mohr's burette with a glass tap, 5 c.c. of the bromine solution added, the mixture acidulated with dilute hydrochloric acid, and well agitated. The liberated bromine will be dissolved by the hydrocarbon, and in most cases will combine with it to form a bromide, or be acted on with production of a bromo-substitution product. In either case, the red colour of the free bromine will disappear partially or completely. If standing a minute or two the layer of hydrocarbon is found to have a marked red or yellow colour, the bromine treatment is at an end, but otherwise a further addition of a known measure of hypobromite solution is made and the agitation repeated.[†]

Excess of bromine solution having been added, as indicated by the permanent red or yellow colour of the hydrocarbon layer, the mixture is allowed to rest a few minutes to permit the aqueous liquid to separate. In some cases this occurs readily, but in others the brominated oil adheres to the sides of the vessel, and, if of about the same density as the aqueous liquid, only separates with great difficulty. In such cases it is desirable to add sufficient petroleum spirit to cause the hydrocarbon to rise readily to the surface.[‡]

Complete separation of the two layers having been effected, the aqueous liquid is run off through the tap into a porcelain basin, and the brominated oil is shaken with sufficient solution of caustic soda to render it colourless. The soda solution is run off into the porcelain basin, the oil washed by agitation with a little water and the washings run off in their turn. Iodide of potassium is then added to the liquid in the basin, and sufficient hydrochloric acid to render it distinctly acid. The mixture is then titrated with the sulphate in the same manner as the bromine solution. The quantity of bromine thus found is the excess employed, and if deducted from the total quantity present in the volume of hypobromite solution added to the oil, the weight of bromine will be found which is required to combine with the quantity of hydrocarbon taken for the experiment.

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[*] It is desirable to ascertain the strength of the hypobromite solution every few days.

[†] In the analysis of shale-naphtha 5 c.c. of the sample often requires an addition of 25 c.c. of bromine solution to effect complete bromination.

[‡] This plan never fails. The petroleum spirit employed may be ordinary commercial "benzoline," but it must be previously agitated with enough bromine water to render it permanently coloured, and then with sufficient caustic soda to decolorize it. Treated in this manner it is rendered indifferent to bromine.

When a solid hydrocarbon, such as vaseline or paraffine, is to be examined, 2 grammes of it should be dissolved in the smallest necessary quantity of petroleum spirit (previously brominated), and the solution so obtained treated in the usual manner.

Operating in the manner above described the method gives very constant results. The following figures show the proportion of bromine which the author found to react with samples of representative commercial products, consisting wholly or chiefly of hydrocarbons. In nearly all cases the numbers given are the mean of two or more concordant experiments.

Substance.	Sp gravity at 15 5° C.	Grammes of Bromine combining with 100 grms. of sample.	Percentage of Bromine in Product.
NAPHTHAS—			
1. Gasolene from Shale	·665	67·1	41·6
2. Gasolene from Petroleum	·652	5 1	4·8
3. Shale Naphtha	·718	94·9	48·7
4. Petroleum Naphtha	·690	10·0	8 8
5. Benzol	·876	36·2	26 6
BURNING OILS—			
6. From Shale	·801	38·7	27·9
7. From Shale	·806	36·4	26·7
8. From Petroleum	·800	17·2	14·7
LUBRICATING OILS—			
9. From Shale	·889	56·4	36·0
10. From Shale (Bloomless)	·875	45·3	31·2
11. From Petroleum (Spindle Valvoline)	·862	21·6	17·7
12. From Petroleum (Oleonaphtha)	·905	31·8	24·1
13. Rosin Oil	·973	45·3	31·2
14. Refined Rosin Oil	·978	42·7	29·9
SOLID PRODUCTS—			
15. Vaseline	—	19·7	16·5
16. Paraffine Wax	—	—	—

From these results it will be seen that there is in each case a striking difference between the proportion of bromine assimilated by any of the shale-products and the quantity which combines with the parallel product from petroleum. Thus, while the shale naphtha took up nearly its own weight of bromine, the petroleum naphtha combined with only 10 per cent., and the gasolenes, burning oils and lubricating exhibit similar but somewhat less striking differences. Benzol does not give a satisfactory result, the reaction with bromine occurring slowly instead of instantaneously, as is the case with the shale of petroleum products.

Owing to the complex character of commercial hydrocarbon products, a determination of the amount of bromine combining with them does not give the means of calculating the actual per-centage of olefines contained in them. If, however, a fraction of constant boiling point were prepared, and its vapour density ascertained, its mean combining weight could thence be deduced, and then a determination of its power of assimilating bromine would give a means of obtaining a close approximation to the proportion of olefines contained in the fraction. This suggestion of course assumes the absence of hydrocarbons of the acetylene series and other bodies simulating the olefines in their reaction with bromine.

Broadly speaking, the relative proportion of olefines present in two products of similar density and boiling-point is pretty exactly indicated by the power of assimilating bromine; and as the shale-products combine with from twice to ten times as much bromine as the parallel products from petroleum, it may be safely assumed that the former products are far richer in olefines than are the latter.

My acknowledgments are due to Mr. W. S. Gunn for the valuable assistance he has afforded me in ascertaining the bromine taken up by various products.

INLAND REVENUE REPORT.

The twenty-fourth report of the Inland Revenue Commissioners has just been issued, and we take from it the following report by the Principal of the Laboratory.—

The number of samples examined during the year ended 31st March last was 18,014, which is 2,901 in excess of the previous year. The increase is principally due to the operation of the new beer duty, and caused a great strain upon the department during the latter half of the year.

Under the Inland Revenue Act, 1880, which abolished the duty on malt, and imposed an equivalent tax on beer, 1,882 samples have been examined. Most of these were for the determination of the original gravity, to confirm or otherwise the gravity declared by the brewer or that found by the officer. As the samples examined at this laboratory are usually taken when the wort is in a partially fermented state, the conditions for obtaining an average sample are more favourable than before fermentation has commenced. The detection of sugar which has been illegally added to wort with the view of increasing the gravity has entailed a considerable amount of work of a kind requiring much skill and experience. We have so far successfully dealt with this form of fraud, and several prosecutions have been instituted against brewers, and a conviction obtained in each case. There appears to be a strong tendency among small brewers, more especially in the Midland Counties, who, through want of skill or attention, fail to get a produce of worts corresponding to the charge from materials, to use a quantity of sugar without entering it upon the brewing paper, and thereby escape payment of duty on a deficiency of produce from the malt. The per-centage of samples in which the true gravity has exceeded that declared has been very considerable.

As the mode of charging the duty on worts called into use a very large number of saccharometers intended as standards, and for general use by officers, the work of verifying many of these instruments fell upon this department. The result led to the rejection of many imperfect instruments.

Twenty-six samples under the Sale of Food and Drugs Act have been referred to us by direction of the magistrates. They comprised milk, butter, coffee, mustard, and tincture of quinine. In twelve instances our certificate agreed with, and in fourteen it differed from, that of the public analyst. In the case of two samples of butter said to contain foreign fat, our results showed that they were genuine butter. In another case a portion of the butter analysed by the defendant's analyst was sent here along with the sample in the hands of the inspector. The results showed that the inspector's sample consisted almost entirely of foreign fat, and that the vendor's sample was a genuine butter. The magistrate held that the seller had improperly changed the sample left with him by the inspector, and thereby committed a fraud on the Court. In the case of two samples of coffee alleged to contain a large per-centage of chicory, traces only of the latter were found. Our analysis of a sample of tincture of quinine confirmed the results of the public analyst. We found that the tincture did not contain more than one-fifth the quantity of quinine found in the article as prepared according to the British Pharmacopœia, and that the quinine was partly replaced by other cinchona alkaloids. In several milk cases we differed from the opinion of the public analyst, as from the results of our analyses we were unable to affirm that water had been added or cream extracted.

In connection with the analysis of milk, and the results which we have obtained from an extensive inquiry into the composition of genuine milk, it is of some interest to direct attention to the confirmation which our results have received from those recently obtained by well-known analysts, and published in a scientific paper. In one instance the analyst found that two cows on the same farm gave milk which contained on the average 8·7 per cent. of solids *minus* fat, the minimum being 8·35. The average per-centage was calculated on the results obtained from an analysis of several milkings. In another case, in which the milk of a herd of 42 cows was analysed, it was found that 25 of the cows yielded milk which contained less than 9 per cent. of solids *minus* fat, the minimum being 8·25 per cent. The analyst's conclusion was that so far as house-fed cattle in Ireland are concerned, the standard of 9·0 per cent. should be reduced to 8·5 per cent. In the above cases the cows were all healthy and properly fed. As it is well known that public analysts generally have adopted 9·0 per cent. as a limit or standard for the "solids not fat" in deciding upon the genuineness of a milk, it is evident that vendors of a genuine milk similar in quality to those above referred to would be exposed to the danger of a prosecution. The results which these analysts have published are such as we have always felt convinced would follow a full and independent inquiry into the quality of milk yielded by different breeds of cows under the varying conditions of food and season, and the fact of these low results having been brought under the notice of the public removes any difficulty we have hitherto felt in publishing our own investigations on the same subject.

The sale of light and non-intoxicating beverages made from sugar and variously flavoured with hops and other materials has increased very much during the past two years. These are sold under the suggestive names of "Non-pale Ale," "Tonic Stout," "Tonicine," "Hopetta," "Champagne Coffee," &c., &c. The stimulus appears to have been given to their sale partly by very successful attempts at imitating ordinary beer in general appearance and flavour, and also by the fact that the influence of the temperance movement throughout the country is largely directed to the promotion of the sale of non-intoxicating drinks as a means of reducing the consumption of alcoholic beverages. In many instances the aëration of the beverage is carried on by causing a slight fermentation to take place in the liquor. As this continues in some cases for a considerable time in the bottle, an amount of alcohol is produced, including that added with the flavouring ingredients, equal to from 4 to 6 per cent. of proof spirit. As these preparations are usually employed as temperance drinks, it is evident that they are not in every case so innocent as they are supposed to be, and I am of opinion that such of them as approach the character of light table beer should, in justice to the brewing trade, be subjected to the beer duty.

The analysts have attended before the magistrates to give evidence in 21 cases in which prosecutions have arisen, and penalties amounting to £314 were imposed.

Forty-one samples have been examined for the Stationery Office, twenty-eight of which were writing ink, eleven liquid gum, and two silk cord.

Twelve examiners have received the usual course of instruction.

Eight students during the year completed the customary course of instruction at the Royal School of Chemistry and in the class of practical chemistry at this laboratory. At the final examination by Dr. Frankland they specially distinguished themselves by taking a high position, and all received first-class certificates.

REPORT OF THE LOCAL GOVERNMENT BOARD.

We take the following from the Blue Book recently published:—

In our last Report, we stated that up to the 31st of December, 1879, the number of Authorities who had appointed analysts, with our approval, was as follows:—

County Authorities	52
Municipal Corporations	139
District Boards and Vestries in the Metropolis	39
	230
Agreements entered into under section 11 of the Statute ...	7
	237

During the year ending on the 31st of December, 1880, appointments were made under section 10 by the authorities of 17 additional boroughs, including one in which an arrangement had previously been made under section 11, and consequently, the total number of authorities who, up to the last-mentioned date have availed themselves of the salutary provisions of this important Act is 253.

We are still in correspondence with the few remaining Authorities who have not yet complied with the provisions of the Statute, and we trust that they will not fail to recognize the expediency of making the requisite arrangements in this respect.

The result of the analyses made during the year is shown in the abstract which is printed in the Appendix. It will be seen that the total number of such analyses is 17,678, or about 500 more than in 1879. Taking the population of England and Wales at twenty-five millions and a half, we find that one sample was analysed for every 1444 persons, a proportion which is perhaps as large as could have been fairly expected considering that the Sale of Food and Drugs Act has at present only been five years in operation. We should be glad, however, to see at least one sample taken annually for every thousand persons throughout the country, and it is unfortunate that many Local Authorities cannot be induced to exercise their powers under the Act. In London, and in about half-a-dozen extra-metropolitan counties, the proportion last referred to is already more than attained, but in twelve English and at least half as many Welsh counties the Act is practically inoperative. In one district in London, that of St. Mary, Newington, no samples were analysed, and in Whitechapel, Shoreditch, Rotherhithe, and several other Metropolitan Districts the number bore an insignificant relation to that of the inhabitants as well as to that of the vendors of articles coming within the scope of the Act. In comparatively few of the smaller boroughs was any action taken in this respect, and even in such populous towns as Birkenhead, Derby, Durham, Exeter, Hartlepool, Northampton, Oxford, and York, either no samples at all, or scarcely any, have been analysed. In many such cases we have endeavoured to induce the Authorities to exercise the power conferred upon them by the 13th section of the Act of 1875, of having samples subjected to analysis from time to time, but we have too often been unable to obtain more than a general statement that as adulteration is not suspected to exist the Town Council deem it unnecessary to harass the local tradesmen. Scarcely enough weight seems to be given in these instances to the fact that the experience of places where samples are analysed shows adulteration to be prevalent to a greater or less extent; and to the consideration that tradesmen who sell genuine goods are not in the least harassed by parting with such goods, at current prices, to an inspector, while they are exposed to serious loss if their rivals are enabled to undersell them by unchecked malpractices. As regards the counties, in several instances the Courts of Quarter Sessions have declined to have samples obtained, apparently on the ground that the duty may properly be left to the Sanitary Authorities, while the Sanitary Authorities have as a general rule done nothing, perhaps because they consider that the work of collection can be best performed by the county police who are under the control of the magistrates. Whichever view be adopted, we are satisfied that it is of great importance that some of the officers specified in the statute should be required to act. On one point experience seems to be conclusive, namely, that where the Authorities do not obtain samples, the Act is scarcely carried out at all. Ordinary purchasers, except in a very few instances, are not found willing to incur the trouble and expense of analyses; and the official purchases amount to about 97 per cent. of the whole. Bristol is almost the only town in which any large number of analyses have been obtained by private individuals, and perhaps this exception is due to the fact that the Town Council have arranged with their salaried analyst to examine each sample for half a crown, instead of the usual fee of half a guinea, which is the maximum allowed by the Act. In Lambeth the Vestry have adopted the plan of notifying to the public that any person believing his purchases to be adulterated may give notice to the Inspector, who will thereupon, with the necessary formalities, obtain some of the suspected article and submit it to the Public Analyst.

The following table shows the number of samples examined during the year and the per-centage of cases in which adulteration was reported. It must be remembered, however, that this per-centage includes a very large number of cases in which the adulteration was so small that no proceedings were instituted, while in some instances the prosecution failed because it was shown that due notification of admixture had been given by the vendor.

———	Examined.	Adulterated.	1879. Percentage of Adulteration.	1880. Percentage of Adulteration.
Milk	6,751	1,448	19·4	21·4
Bread	1,096	70	7·3	6·4
Flour	409	4	2·4	1·0
Butter	1,155	211	13·0	18·3
Coffee	1,211	233	18·9	19·2
Mustard	872	138	19·0	15·8
Pickles (including Tinned Vegetables)	46	1	2·2	2·2
Sugar	244	—	0·4	—
Jam	29	2	1·9	6·9
Confectionery	174	—	1·5	—
Wine	67	13	10·7	19·4
Beer	465	19	3·6	4·1
Gin	769	155	21·7	20·1
Spirits other than Gin	1,289	334	30·8	25·9
Drugs	405	63	27·8	15·5
Other Articles	2,691	81	6·1	3·0
Total	17,673	2,772	14·8	15·7

It will be seen from this table that the per-centage of adulterated samples, which fell from 19·2 in 1877, to 17·2 in 1878, and 14·8 in 1879, again rose to 15·7 in 1880. This result is principally accounted for under the two heads of milk and butter.

More than a third of the whole number of samples examined were of milk, and we regret to find that the improvement in the quality of this article, which we were able to record in the two previous years, was not maintained in 1880. The per-centage of adulteration throughout England, which had fallen from 24·1 in 1877 to 19·4 in 1879, was 21·4 in 1880. In the Metropolis no less than 27·5 per cent. of the samples taken were reported against.

The proportion of milk adulteration detected varies very much in different districts. As regards the Metropolis we find that in the city of London 16 samples out of 26 are reported against, in Marylebone 9 out of 14, in St. Olave 8 out of 12, in Woolwich 48 out of 81, in Paddington 36 out of 79; while in Lambeth the proportion is only 16 out of 197, in Wandsworth 10 out of 117, and in St. James's Westminster all the samples were found genuine. This last-mentioned district, by the way, seems to enjoy a singular immunity either from adulteration or from its detection; for out of 220 samples of all kinds examined during 1880 not one was found adulterated, and 67 samples were examined in 1879 with a similar result. We have no information as to how the samples in question are collected, but the case is so exceptional as to deserve special notice.

Of the eight most populous provincial towns, we find that Birmingham again figures conspicuously with 39 adulterated samples of milk out of 82 examined, Manchester has 35 adulterated out of 119, Salford 73 out of 298, Bristol 36 out of 144, Sheffield 4 out of 25, Liverpool 34 out of 277, Bradford 7 out of 60, and Leeds 4 out of 42. All these towns, therefore, except Birmingham and Manchester, are better off in this respect than the Metropolis.

No doubt the ease and profit of milk adulteration make its suppression a matter of great difficulty; but we had hoped that the measures adopted under the Act would have produced a continued diminution in this description of fraud. In some cases the amount of added water is so large as to be, according to the analyst for Plumstead, "a serious matter for health, and even for the lives of infants." At Salford some of the samples contained more than 30 per cent. of added water, the defence put forward being that this was merely owing to the cows having been poorly fed. In one case the farmer swore that he had fed his cows on nothing but straw, and the analyst remarks that if this defence were true the case would have been suitable for investigation by the Society for the Prevention of Cruelty to Animals. The same analyst states that he had visited several farms when he was not satisfied with the milk delivered from them to the dealers, had seen the cows milked, analysed the milk, "and thus judged the farmer by means of a jury of his own cows." The analyst for Durham, in reference to the difficulty of distinguishing between adulterated milk and milk that is genuine but very poor, suggests that the farmer who disputes the accuracy of an analysis, and pleads the natural poverty of particular milk, should be required to call in the analyst to see the cow milked, and to take a sample for comparison, and that till this has been done no appeal should be allowed. The fact that the milk trade is largely in the hands of petty dealers has probably led in some instances to leniency as regards the amounts of the penalties imposed, and the frequent repetition of the offence by the same persons shows that they often find it profitable to pay the fines and go on adulterating. In one case which was the subject of proceedings in the past year the milkman was not deterred by seven previous convictions, under which he had paid an aggregate of over £70 in fines alone, and on the eighth conviction was mulcted in the full penalty of £20 and costs.

The provision of the Act of 1879 authorising the taking of samples at railway stations before delivery to the retailers, has been found very useful, by enabling the dairyman to protect himself against the consignment to him of adulterated milk. Some doubts at first arose as to the mode of carrying out this section, for it would be obviously impracticable, in most instances, to observe the formalities, as to notice of analysis and division of sample, which are enacted by section 14 of the Act of 1875 for the protection of the seller. This supposed difficulty, however, was removed by the decision of the High Court of Justice that the procedure referred to was not applicable to the case. The honest milkman is thus effectually protected, and the dishonest one who sells watered milk has at least the satisfaction of being able to make sure that he has not been anticipated in watering it: the public, too, escape the double dilution. It is not surprising to find that samples taken at the railway station are as a general rule of much higher quality than those bought from the retailers. The analyst for Liverpool observes, that of 80 samples so taken, all but two were found genuine, and that the average quality was at least 15 per cent. richer than the average quality of milk purchased by the inspectors from dairymen, even omitting samples known to be watered.

Of the samples of bread examined about 6·4 per cent. are reported against, and this result compares very favourably with previous returns. The adulteration was generally alum, introduced in order to whiten the bread, but likely to impair the digestive organs, if taken in large quantities; and bread such as that reported by the analyst for Essex as containing no less than 1,805 grains of alum to the quartern loaf, would no doubt have been exceedingly harmful to anybody whom its nauseousness did not prevent from consuming it. Nor would oatcakes containing 10 per cent. of chalk, as reported by the Cheshire analyst, be wholesome food. Baking powder appears to be responsible for some of these admixtures and the question has been much discussed whether the use of certain kinds of aluminous powder does in effect make bread injurious to health, or whether, as contended by the manufacturers, such bread is no less wholesome than that baked with ordinary yeast. One analyst, however, reports the discovery in some "Baker's Mixture" of a considerable amount of arsenic, due to its having been made from impure chemicals, and he comments on the danger of introducing so virulent a poison into bread.

By the use of such mixtures, usually manufactured from phosphates of lime and magnesia treated with sulphuric and hydrochloric acids, bakers are enabled to make bread of good appearance from inferior flour. The flour as sold, however, is very little tampered with, only four samples out of 409 having been reported against, among which was some so-called "Russian flour," that consisted solely of potato starch with a little sulphate of lime.

A good deal of attention has been directed during the year to the increased consumption of butterine, which is beginning to take an important place as a substitute for butter among the poorer classes. Some of this substance is reported to be "so close an imitation of the real article, that a very careful chemical analysis is necessary to distinguish the two," although it is usually sold at about 1s. a pound or less. Its wholesomeness has been called in question in America, but among English Public Analysts there seems to be a concurrence of opinion that it is unobjectionable in this respect, and no trichinæ or other living organisms appear to have been detected in it. There is no doubt, however, that it is too often sold where butter is asked for, and the similarity of name probably aids in this deception; for in one case in which proceedings were taken, it was shown that a label containing the words "10d. per lb." had been placed so as to hide the last syllable of the word "Butterine."

The per-centage of adulterated samples of coffee remains about the same as in previous years. Chicory continues to be the chief adulterant, and the cases are numerous in which the proportion added is very large. One sample of so-called coffee was found to consist entirely of this inexpensive root; and an article extensively sold as "French coffee," has been ascertained from various analyses, to contain from 40 to 70 per cent. of chicory. In one case, indeed, we learn from an analyst's report that the vendor of a preparation advertised as "Fine French coffee, a blend of finest East India and other coffees, carefully prepared by the new French process, whereby the aroma and properties of the coffee are fully developed," was prosecuted and fined, because the French developing process was discovered to have consisted solely in the mixture of the enormous proportion of 90 per cent. of chicory with 10 per cent. of coffee. Another substance sold as "Turkish Luxury," was composed of three parts of chicory, added to one of coffee. As chicory is stated to be destitute of the active principle and volatile oil which are the most valuable properties of coffee, its unacknowledged admixture with coffee is objectionable from a dietetic point of view, though it is exceedingly profitable to sell an article that costs about 4d. a pound at the price of genuine coffee.

The so-called adulteration of mustard is really to some extent a question of nomenclature. Most people, in buying mustard for table purposes, desire not ground mustard seed alone, but the preparation which it is now necessary to label as a mixture.

All the 244 samples of sugar examined were pronounced to be genuine, and the application of adulteration to this article may now be regarded as obsolete. We are glad to remark, too, that in the sweetmeats examined no instance was found of the use of those deleterious colouring matters which were formerly extensively employed.

Of wines only 67 samples were examined, and nearly all were found genuine, except some so-called "unfermented" wines sold as "Temperance Drinks," which professed to be composed of pure grape juice, but were really mixtures of tartaric and salicylic acids, sugar, and flavouring matter. Some of these also contained a dangerous amount of copper, due probably to the manufacture having been carried on in vessels of which the acids had dissolved part of the metal. In several instances spirit was also present, notably in one sample labelled, "The selected Wine of the Temperance Fraternity," which was reported as "containing a large amount of alcohol." Some samples of ordinary Tent wine were also examined, and were found to have been brandied, one of them so freely as to make it contain the enormous proportion of 40 per cent. of proof spirit.

Very little adulteration of beer has been detected. In the Metropolis, the 127 samples examined were without exception reported as genuine; and in the rest of the country the few samples reported against for the most part merely contained an excess of salt. In Chester, however, some samples were reported as "only coloured alcoholic waters, which were not produced from pure malt and hops; some contained a considerable amount of salt, more than twenty times what is found in good beer." It may be also that sugar and water are occasionally added to beer, and that this addition escapes detection on analysis owing to the speedy conversion of the sugar used; but the deleterious forms of adulteration appear to exist no longer.

In spirits the per-centage of adulteration remains high, although it might have been anticipated that the lowness of the standards of genuineness fixed by the Act of 1879 would have produced a different result. In most cases water alone was added, sometimes with caramel as colouring matter. One sample was reported as containing decaying vegetable matter with fungoid growth, apparently due to its having been diluted with dirty water.

In drugs a substantial improvement is shown, the proportion adulterated being little more than half what it was in 1879. In some instances a cheap substitute had been purposely employed in place of a costly drug, as "cinchonine" in lieu of quinine. In other instances, the sale of one article in place of another was probably due to a mistake, as where sulphate of zinc was issued instead of Epsom salts. In other instances, drugs were found to be considerably below the strength specified in the British Pharmacopœia, sometimes no doubt owing to intentional dilution, but probably sometimes, as in the case of sweet spirits of nitre slightly deficient in nitrous ether, owing to the accidental escape of volatile spirits which had originally been present. In one class of cases which generally figures conspicuously in these returns, chemists are not the delinquents. A good many of the samples were those of so-called "paregoric," which were reported as adulterated because they were destitute of the opium which is the most important constituent of the genuine compound. The fact is, according to the analyst of the West Riding of Yorkshire, that such substitutes are ordinarily sold by small shopkeepers who are not chemists, and who therefore are prohibited by the Pharmacy Act from dealing in an article containing poison. On the general question of the adulteration of drugs, we may refer to the observations in our previous reports, and may reiterate our opinion that the importance of obtaining pure medicines makes it desirable that a larger number of samples than heretofore should be submitted for analysis.

Of the articles not specified by name in the table printed above, some of the principal were arrowroot, oatmeal, tea, pepper, aerated waters, and tinned meat and fruits. Arrowroot was occasionally found adulterated with tapioca, flour and similar substances, and oatmeal with barley flour. Tea was in some cases reported to have been made up with exhausted leaves and to have been faced to excess, but the instances of this were so rare as to show that the examination of tea in bond by the analysts of the Commissioners of Customs has produced an excellent effect on the retail trade. Pepper was almost uniformly genuine. Among the aerated waters, instances were again found of the introduction of lead by careless processes of manufacture. The result of the analysis of tinned foods was on the whole decidedly satisfactory, although in one or two instances either the soldering or the tin had been corroded, and part of the metal had been absorbed in the liquid contents so as doubtless to render them unwholesome.

Of the 17,673 samples above referred to all but 337 were obtained by officers appointed under the Act of 1875. Of those purchased privately about one-third were found adulterated, of those purchased officially about one seventh. This difference is of course mainly explicable by the fact that a private purchaser's suspicion of adulteration is ordinarily pretty strongly aroused before he bestirs himself to put the Act into operation on his own account. Moreover, there is little doubt that in some cases of official purchases sufficient care is not taken to prevent the inspector being recognised as such, and served with a superior article.

Several important decisions of the High Court of Justice have been given during the year with reference to the Sale of Food and Drugs Acts. In the case of Horder v. Mannings, an inspector having asked for coffee was served with an article taken from a canister labelled "Symington's coffee." He thereupon stated that he wanted the coffee for analysis, on which the vendor put it into a paper labelled "this is sold as a mixture of chicory and coffee," and delivered it to him. The "coffee" being found by the analyst to contain 85 per cent. of chicory, it was held that it was no defence for the vendor that he sold it just as he had received it from the manufacturer, for if he was cognisant of so great a proportion of chicory to coffee in the article sold, he made himself a party to the manufacturer's fraud (44 J. P. 234). In the case of Horder v. Scott it was decided that an inspector appointed under the 13th section of the Act of 1875 may employ a deputy to purchase articles for the purpose of analysis, and may properly institute proceedings against the seller of such articles if the result of the analysis discloses an offence against the Act (L. R. 4 Q. B. D. 552). In the case of Rouch v. Hall (already referred to) a sample of milk from the country was taken at Euston station, and it being assumed that the procedure prescribed by section 14 of the Act of 1875 was applicable to section 3 of the Amending Act of 1879, notification of analysis was given to a railway porter in charge of the milk, and one-third of the sample was left with him. On this it was held that although the porter could not be regarded as the agent of the consignor, yet where a sample of milk in course of delivery is procured for analysis under section 3 of the Act of 1879, it is not necessary for the officer procuring such sample to notify to the seller or his agent his intention of having the sample analysed, or to deliver to the seller or his agent a portion of the sample in accordance with section 14 of the Sale of Food and Drugs Act, 1875 (L. R. 6 Q. B. D. 17).

TOTAL NUMBER OF SAMPLES.

	Examined.	Adulterated.	Proportion adulterated.	
			1880.	1879.
The Metropolitan District	5039	734	14·5	12·7
COUNTIES.				
Bedford	313	22	7·0	12·1
Berks	78	12	15·4	7·8
Bucks	—	—	—	0·0
Cambridge	62	8	12·9	24·3
Chester	940	185	19·6	15·3
Cornwall	11	7	63·6	42·8
Cumberland	105	11	10·4	12·6
Derby	104	30	28·8	29·8
Devon	72	16	22·2	26·2
Dorset	16	9	56·2	—
Durham	568	127	22·3	29·7
Essex	331	13	3·9	6·4
Gloucester	638	45	7·0	7·5
Hereford	—	—	—	0·0
Herts	—	—	—	100·0
Hunts	18	13	72·2	0·0
Kent	441	94	21·3	27·7
Lancaster	2539	446	17·5	17·4
Leicester	265	33	12·4	9·7
Lincoln	283	30	10·6	16·4
Middlesex	284	46	16·2	23·1
Monmouth	84	23	27·4	25·0
Norfolk	98	31	31·6	29·1
Northampton	108	13	12·0	15·2
Northumberland	193	33	17·1	12·2
Nottingham	44	9	20·4	19·0
Oxford	15	6	40·0	25·0
Rutland	10	2	20·0	—
Shropshire	13	2	15·4	0·0
Somerset	723	40	5·5	5·6
Southampton	428	73	17·0	21·0
Stafford	1006	162	16·1	12·6
Suffolk	4	2	50·0	0·0
Surrey	500	105	21·0	13·2
Sussex	339	57	16·8	10·0
Warwick	260	67	25·7	22·8
Westmoreland	16	3	18·7	16·6
Wilts	107	8	7·4	5·7
Worcester	154	22	14·2	12·4
York, E. Riding	144	26	18·0	18·2
„ N. Riding	70	14	20·0	14·3
„ W. Riding	578	99	17·1	21·0
WALES.				
Anglesey	3	1	33·3	15·3
Brecknock	79	24	30·4	66·1
Cardigan	13	4	30·7	—
Carmarthen	18	2	11·1	17·1
Carnavon	6	4	66·6	—
Denbigh	9	2	22·2	25·0
Flint	20	9	45·0	7·4
Glamorgan	467	36	7·7	5·1
Merioneth	26	2	7·6	—
Montgomery	—	—	—	0·0
Pembroke	16	5	31·2	—
Radnor	15	5	33·3	—
Totals	17673	2772	15·68	14·86

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in September, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Sept. 16	clear, pale blue	none	1·98	trace	·672	none	·0026	.0020	.0080	19·0°	6·4°	31 80	satisfactory	Wigner & Harland.
New River	„ 15	clear	none	1·12	trace	·189	·0006	·0014	·0210	·0310	11·0°	3 0°	18 76	satisfactory	B. Dyer.
East London ..	„ 14	c. yellow green	none	1·37	trace	·178	·0015	·0066	none	·0380	13 0°	4·2°	19·[illegible]0	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	„ 17	c. v. p. yellow	none	1·24	trace	·150	·0005	·0070	·0280	·0616	13·5°	3·5°	21·15	satisfactory	J. Muter.
West Middlesex	„ 19	yellow green	none	1·17	trace	·141	·0006	·0045	·0510	·0810	12·4°	2·7°	19 66	vegetable debris	O. Hehner.
Grand Junction	„	p. grnsh yellow	none	1·12	trace	·210	·0008	0067	·0064	·0984	13 0°	3·5°	18·40		A. Wynter-Blyth.
Lambeth	„ 02	c. v. p. yellow.	none	1·24	trace	·150	none	·0063	·0250	·0504	13·3°	3·5°	21·28	satisfactory	J. Muter.
Chelsea	„ 12	c.p.brnsh. green	none	1·19	trace	·230	none	·0060	·0420	·0870	11.5°	3·5°	18·48		A. Dupre.
Birmingham ..	Sept. 5	grnsh. ylw. turb.	none	1·40	trace	·198	·0014		·0081	·0440	8·8°	5·4°	16 83	veg. deb. & liv. veg. frms.	A. Hill.
Bolton	„ 7	s. turbid	none	·50	none	·030	·0016	·0048	·0045	·0150	3 5°	3·5°	8·70	mineral matter	W. H. Watson.
Bradford	„ 21	pty. yel. v. s opqe.	none	·65	none	none	none	·0042	·0350	·1650	3·5°	3 4°	7·7	none	F. M. Rimmington.
Brighton	„ 9	c. pale blue	none	2·05	none	·350	·0028	·0019	none	none	13·0°	3·4°	19·80	vegetable debris	Wigner & Harland.
Bristol	„ 6	pale green	none	·68	trace	·093	·0013	·0056	·0210	·0588	14·0°	1·5°	18·40	algæ sand	F. W. Stoddart.
Bury (Lan.) ..	„ 7	s. turbid	none	·82	none	·042	·0032	·0093	·0060	·0210	4·5°	4·4°	8·80	mineral mttr. & veg. deb.	W. H. Watson.
Cambridge	„ 13	c. pale blue	none	1·40	traces	·413	·0004	·0020	none	·0103	17·0°	4·5°	23·80	satisfactory	J. West Knights.
Canterbury	„ 12	c. pale blue	none	1·47	none	·387	·0005	·0008	·0020	·0104	5·4°	4·0°	8·68	slight mineral	S Harvey.
Darlington	„ 13	s. turb yel. grn.	s. peaty	·63	trace	·011	none	·0063	·0150	·2823	6·3°	3·9°	9·80	earthy matter	W. F. K Stock.
Edinburgh	„ 9		none	·64	none	trace	·0024	·0064	·0128	·1027	4·7°	4 0°	6·08	none	J. Falconer King.
Exeter	„ 4	f. brnsh. yellow	none	·84	trace	·127	·0014	·0031		·0861	2.8°	2·8°	5·60		F. P. Perkins.
King's Lynn ..	„ 14	yellow opaque	weedy	1·68	traces	·245	·0005	·0098	·0368	·3252	12·8°	4·3°	21·21	animalculæ veg. debris	W. Johnstone.
Leeds															
Leicester	„ 19	s. yellow	none	1·10	traces	·073	·0011	·0025	·0030	·0720	7·5°	5·0°	15·70	satisfactory	W. L. Emmerson.
Liverpool	„ 14	grnsh. yellow	s. peaty	1·02	traces	·031	·0021	·0056	·0530	·0780	3·4°	3·2°	7·14	slt. deposit, confervæ, &c.	A. Smetham.
Maidstone—															
Wtr. Company	„ 14	clear green	none	2·80	traces	·230	·0007	· 035	·0084	·0168	19·0°	6·6°	39·41	none	M. A. Adams.
Public Conduit	„ 14	c. light blue	none	2·30	traces	·280	none	·0021	·0028	·0140	20·0°	6·6°	35·28	none	M. A. Adams.

SOCIETY OF PUBLIC ANALYSTS

Analyses of English Public Water Supplies in September, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	OXYGEN, Absorbed in		HARDNESS, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Manchester....	Sept. 16	s. turb. f. yellw.	none	·61	none	none	·0042	·0045	·0439	·0658	2·7°	2·2°	5·51	s. mineral	W. Thomson.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·79	trace	·040	·002	·0110	·0890	·1440	13·4°	4·9°	16·30	satisfactory	J. Pattinson.
Norwich	,, 12	p. grnsh. yellow	none	1·90	trace	·032	traces	·0019	·0443	·0828	11·0°	3·8°	13·60	satisfactory	W. G. Crook.
Nottingham ..	,, 23	c. green blue	none	·149	traces	·625	·0129	·0119	none	none	9·8°	6·6°	17·80	veget. deb. animalculæ.	Wigner & Harland
Plymouth	,, 15	turb. brnsh. grey	none	·34	none	none	none	·0114	none	·0420	2·0°	2·0°	3·76	vegetable debris	R. Oxland
Portsmouth ..	,, 14	s. turbid	none	1·15	trace	·203	trace	·0018	none	none	13·5°	2·0°	19·30	dec. veg. mtr. & diatoms	W. J. Sykes.
Reading	,, 14	f. yellow	none	·11	trace	·150	·0007	·0049	·0028	·0450	13·5°	4·0°	18·77	none	J. Shea.
Rugby	,, 4	p. yel. f. turbid	v. faint	1·48	trace	·097	·0028	·0261	·0430	·0936	11·8°	10·6°	15·4	veg. debris, bacteria, &c.	A. P. Smith.
Salford	,, 1	c. bright yellow	none	·70	none	none	·0007	·0021	·0163	·0728	3·5°	3·0°	3·5	none	J. Carter Bell.
Shrewsbury ..	,, 5	c. colourless	none	1·45	traces	·264	none	·0010	·0036	·0073	23·0°	4·0°	25·0	none	T. P. Blunt.
Southampton ..	,, 20	yellowish	none	1·40	h. trace	·490	·0023	·0063	·0090	·0880	12·5°	4·3°	17·3	vegetable debris	A. Angell.
Swansea	,, 17	s. turbid	none	1·00	trace	none	·0010	·0053	·0030	·0040	3·0°	2·5°	4·55	none	W. Morgan.
Tunbridge Wells	Aug. 23	brnsh. yellow	none	2·10	trace	·219	·0005	·0006	none	none	4·4°	2·6°	8·34	satisfactory	A. H. Hassall.
Warwick	Sept. 6	c. greenish	none	1·47	none	·369	·0007	·0028	·0315	·0497	23·6°	12·6°	26·04	none	A. Bostock Hill.
Whitehaven ..	,, 1	c. f. green	none	·35	traces	·006	none	·0017	0052	·0170	·4°	·4°	1·89	satisfactory	A. Kitchin.
Wolverhampton	,, 16	s. yellow	none	1·33	traces	·095	none	·0035	·0028	·0173	13·1°	6·2°	21·56	veg. debris, diatoms	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

Tunbridge Wells.—The sample tested was taken from the covered reservoir at Pembury, about four miles from Tunbridge Wells; this reservoir is supplied by seven different springs in the neighbourhood, the quality of each of which differs somewhat, but the sample tested represents the mixed water of all the springs. From Pembury the water is pumped to the Blackhurst reservoirs, which are also covered, and which are at sufficient elevation to allow of the supply of the higher parts of the town, as Mount Ephraim. The supply is on the intermittent system, and in summer is somewhat deficient in quantity. Fresh reservoirs are, however, about to be constructed, capable of holding a three months' supply.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of the public water supplies from January to June, and the valuation of the July, August and September waters.

	Average to June.	July.	August.	Sept.
LONDON—				
Kent	30	27	20	27
New River	26	17	17	21
East London	32	39	20	28
Southwark and Vauxhall	34	28	31	27
West Middlesex	30	24	29	39
Grand Junction	30	23	25	30
Lambeth	37	29	31	26
Chelsea	30	26	32	36
Bath	12	19	20	..
Birmingham	33	37	26	29
Bolton	..	17	19	17
Bradford	53	53	59	44
Brighton	24	23	25	21
Bristol	22	27	..	30
Bury	..	35	24	24
Cambridge	28	26	22	21
Canterbury	17	22	16	12
Coventry	33	..	..	..
Croydon	27	30	..	..
Darlington	33	39	96	50
Derby	18	13	..	..
Droitwich	39	..	..	..
Dublin	23	..	13	..
Dudley	45	..	..	..
Edinburgh	28	21	20	24
Exeter	20	16	23	23
Grantham	27	..	32	..
Hastings	..	20	25	..
Huddersfield	23	26	28	..
Hull	23	..	..	..
Ipswich	27	30	30	..
King's Lynn	94	110	48	110
Leamington	26	..	26	..

	Average to Jun .	July.	August.	Sept.
Leeds	35	28	22	..
Leicester	42	24	26	23
Liverpool	36	29	41	47
Llandrindod	13	..	..	
Maidstone Water Compy.	39	34	30	31
,, Public Conduit	36	28	25	27
Manchester	22	17	29	28
Newark	39	46	41	..
Newcastle-on-Tyne	37	40	48	68
Northampton	44	..	..	..
Norwich	36	49	*36	38
Nottingham	39	46	38	42
Oldham	23	..	..	..
Plymouth	29	..	..	28
Portsmouth	30	22	26	27
Reading	25	20	34	23
Rochdale	9	7	9	..
Rugby	41	..	..	46
Salford	18	14	21	21
Sevenoaks	20	..	..	..
Sheffield	22	..	..	..
Shrewsbury	23	..	17	19
Southampton	43	..	40	40
Stockport	17	..	..	..
Stourbridge	37	..	..	..
Stourport	37	..	..	..
Sunderland	25	27	..	..
Swansea	16	14	19	15
Tunbridge Wells	..	..	..	35
Warwick	34	34	..	10
Whitehaven	9	17	14	30
Wolverhampton	46	39	32	15
Worcester	55	..	..	..

* By a printer's error this was reported, last month, 56.

Taking the Metropolitan waters, we find that the average valuation of the supplies for September is about 3·5 higher than that for August, the valuation being now nearly 29·3. This is, however, lower by 1·8 than the average for the first six months of the year.

The most pure of the provincial supplies, during September, were Whitehaven, with a valuation of 10; Canterbury, 12; Swansea and Tunbridge Wells, 15 each; Bolton, 17; and Shrewsbury, 19; and in some, although not all, of these cases there is a slight improvement upon the August waters.

The following supplies also show an improvement upon the August waters, viz., Bradford, Brighton, Darlington, Leicester, and Wolverhampton.

On the other hand, the analyses of the following waters give less satisfactory indicacations, viz., Birmingham, Bristol, Edinburgh, King's Lynn, Liverpool, Maidstone, Newcastle, and Nottingham.

WATER ANALYSTS.

Special attention is drawn to the fact that it appears that some analysts have reported results of oxygen absorbed last month as relating to absorption in two minutes, instead of 15 minutes, as arranged under the new instructions. The Water Committee will be glad if the time of 15 minutes will be strictly attended to by analysts in future, and reports made as to the month in which the change was made.

COPYING INK FOR READILY TRANSCRIBING LETTERS WITHOUT A PRESS.

By Professor Attfield, F.R.S., &c.

The following paper was read at the York Meeting of the British Pharmaceutical Conference:—

The author stated that he had for the past 13 years used an ink which he copied into an ordinary thin-paper copying-book with no more effort than is employed in using a piece of blotting-paper, that is by simply pressing with the hand. This ready transcription is accomplished by using ink which dries slowly. The ink will of course be affected as to its drying by the weather, the absorbency of the paper on which it is written, by the thickness of the strokes, and so on; but practically the writer provides for these difficulties. Professor Attfield himself uses the ink from year's end to year's end without any trouble whatever. A firm of manufacturers had some time ago gone to the expense of provisionally patenting it in the hope that before the period of provisional protection elapsed it would be improved sufficiently to render it an ordinary commercial article. They had abandoned that hope, and so had the author. He now, however, offered the mode of making it to others for their own use, and possibly for druggists' sale. The principle of the method consists in dissolving a moderately powerful hygroscopic substance in an ordinary ink. After experimenting on various substances glycerine was found preferable. Reduce, by evaporation, ten volumes of ink to six; then add four volumes of glycerine. Or manufacture some ink of nearly double strength and add to any quantity of it nearly an equal volume of glycerine.

Nice Nourishment.—Any one thinking of spending the winter in Nice had better take all his provisions or an analyst with him, for, according to the *Pharmaceutische Zeitung*, July 29, 1881, of 850 analyses made in June of food and beverages sold there, no less than 559 were found to be seriously adulterated.

ANALYST'S REPORT.

Dr. Bernays, the professor of chemistry at St. Thomas's Hospital, and analyst to the Southwark District Board of Works, has just issued to that body the result of his analyses for the past year, in which he states that five samples of spirits analysed showed that with one exception the percentage of alcohol was up to and even beyond the legal standards. Two samples of cyder, one on draught and the other bottled were both good of their kind. Neither of them contained a trace of metallic contamination, and both possessed a most pleasant odour of apples. The bottled cyder was preferable, in that it was less sweet and less liable to acescence. A non-alcoholic drink very much thought of at the present time, answering to the description of a tonic, was well aërated, and contained double its volume of carbonic acid, besides phosphorus in an oxidised form, and a notable quantity of iron. Speaking for himself, Dr. Bernays would prefer a glass of Burton ale, or, if he were an abstainer, a glass of water.

PURE OR ADULTERATED WINE.

The subject of wine adulteration continues to engage a great amount of attention both in Germany and France. In the former country, as most of our readers must doubtless be aware, more penal enactments have been recently passed with a view to the repression of anything in the shape of adulteration, and also to define with approximate clearness what is natural and what is artificial wine. Some difficulty appears to be experienced in establishing this definition. Chemists all over the world are very much alike, and those in Germany appear to be no less infallible in respect to analytical work than those in this country. There have recently been in Germany several prosecutions against wine merchants for the sale of adulterated wine, and many learned *savants* have given certificates of analysis to the effect that such wine ought not to be permitted to enter into consumption. These certificates have in many instances been called in question on behalf of the incriminated wine merchants, and rebutting evidence has not unfrequently shown that the analytical *ipse dixit* is practically entitled to not the least respect. The addition of water to wine has been the great cause of complaint, and with regard to the precise percentages of water added the German chemists have differed materially and egregiously erred. Their inaccuracies, of course, have been exposed in court, and it has been shown that they are more or less ignorant of the vinous properties naturally appertaining to wine, and those which an ingenious manipulator may have subsequently added on his own account. In France they manage things in a somewhat different fashion. The authorities there are determined to repress the adulteration of articles of food and drink—a very meritorious determination which, it is to be hoped, they will be able to successfully accomplish. They have established a municipal laboratory for the special analysis of suspected samples, and this seems to have given a great stimulus to the work of detecting adulteration. Numerous prosecutions of dealers have consequently been instituted, and special attention has been given to the wine trade. In reference to one of these prosecutions we notice that it was recently heard before the Eighth Chamber of the Tribunal of the Seine, the defendant being a wine merchant of Paris, who, in the reports is described as "M. D.," his full name not being given. He was charged with having sold a falsified wine, and from the evidence it transpired that he had been previously convicted of a similar offence. From the report of the chemist of the municipal laboratory the following facts are gleaned:—"M.D." who sold at 65 centimetres per litre a wine, the first cost of which was 73 cèntimes, added to this wine a certain quantity of water; his customers were distinctly informed of such addition, and a notice above his counter told the public that natural wine cost one franc per litre: This being the case, the defendant's advocate (M. Meurge) urged that no legal fraud had been committed, but the court sentenced the defendant to six days' imprisonment, a fine of 50 francs, and the cost of advertising the judgment. It must be noted that before any analysis of his wine had been made "M. D." had spontaneously admitted that he added 15 per cent. of water to it. The analysis of the municipal laberatory showed 9·20 of alcohol, and 18.50 dry extract, vinous elements which protect the merchant from prosecution, so that without the admission of "M. D." it is not probable that he would have been brought before Seine tribunal. Notice may also be taken of the negligence with which analyses appear to be conducted in the municipal laboratory. The report on this wine stated the existence of a foreign vegetable colourant, but without indicating its nature, and no information was given to the court with regard to the qualities of the wine. In consequence of these omissions, and in virtue of an analysis made by the able chemist of the Wine Trade Syndicate, the counsel employed by "M. D," asked that the wine should again be analysed by some competent and reliable authority. This request, however, was somewhat unreasonably refused, which shows that French tribunals are not disposed to show any favour to people who are brought before them accused, rightly or wrongly, of adulteration.—*Grocer.*

LAW REPORTS.

Summons dismissed because taken out by person who had had the analysis made :—

A curious case was tried at Exeter recently. The Governors of the Devon and Exeter Hospital pay a large sum annually for milk, and they deem it of the highest importance that the milk supplied should be of the best quality, as it formed the chief food of children and typhoid fever patients in the Institution. An analysis was made, when it was found a great deal of the cream had been taken from the milk. When steps were being taken in connection with the analysis, the contractor wrote to the committee stating that if he had had more cows of his own, the cause of complaint would not have arisen, and he promised to get more, and supply milk only from these. He also pointed out that his family had been the contractors for thirty years. The Governors, however, decided to proceed against the contractor and he was summoned for having abstracted a certain portion of the milk, so as to injuriously affect its quality. A technical objection was taken that the prosecution was in the name of the person who had caused the analysis to be made; and the Bench ruling the objection to be good, dismissed the summons.

Milk Adulteration Cases :—

At the Thames Police Court, Henry Haveringham, of 26, Tapley Street, Bromley-by-Bow, was summoned under the Food and Drugs Act for selling adulterated milk. Evidence was given which showed that the public analyst of the district had found the sample submitted was adulterated with fourteen per cent. of water. The defendant said he put half a pint of water into a large quantity of milk. He was seventy-two years of age, and his wife seventy-four, and they were trying to earn a crust the best way they could. The magistrate said the defendant was cheating poor people who dealt with him, and fined him 20s. and 2s. costs.

Rebecca Bacon, of 145, Crisp Street, Bromley, similarly summoned, was fined £3 and 21s. costs.

Butterine Sold by an Assistant :—

At the Wednesbury Police Court, lately, Mr. Timothy Carter, grocer and provision dealer, Steelhouse Lane, Birmingham, was charged before Mr. F. F. Boughey (stipendiary), by Mr. Horder, the inspector under the Sale of Food and Drugs Act for the South Staffordshire district, with selling butter which was not of the quality and nature demanded by the purchaser. Mr. Stirk, of Wolverhampton, appeared for the defendant. Francis Henry Somerville, an assistant to Mr. Horder, stated that, on the 22nd ult., he visited a stall kept in the Wednesbury market by the defendant, and asked to be supplied with one pound of butter. An assistant supplied him with an article which he supposed to be genuine butter, for which he paid 8d. He informed the assistant that the article supplied him would be analysed by the county analyst (Mr. Jones), and if it were found to be adulterated, his employer would be summoned before the magistrate. Upon this the assistant stated that the article supplied was butterine. By Mr. Stirk: He was quite sure that he asked for butter. He was not told the article, before being supplied him, was butterine. It was after it was purchased that he was informed that it was butterine. In reply to Inspector Horder, witness stated that he had bought butter at 8d. per lb., which the analyst had certified to be pure. Mr. Horder stated that, on the 4th inst., he received two packets from the last witness, and he delivered one of them to the county analyst (Mr. Jones), who had since sent him a certificate to the effect that the article was not butter, and contained less than 1 per cent. of real butter fat. The analysis was: water 6·55, salt 1·32, curd 1·50, fat 90·53. Mr. Stirk said the article was not sold as butter, but as butterine; and as it was supplied by a young assistant, he trusted the Stipendiary would dismiss the case. The Stipendiary said he considered the case clearly proved, and as it was highly important that the public should be supplied with genuine articles, it was necessary that he, as a magistrate, should enforce the law. He considered the present case a bad one, and defendant would have to pay a fine of £5, and £1 14s. 6d. costs.

Coffee and Chicory Cases :—

At Clerkenwell Police Court, on September 9, Mr. Matthew Manns, grocer, of 270, Goswell Road, was summoned for having sold coffee adulterated with an admixture of chicory to the extent of 15 per cent. Inspector Eadds, inspector of nuisances, for the parish of St. Luke's, prosecuted. Four ounces of the coffee were purchased by a woman on August 5, at the instance of the inspector, and it was found to be adulterated in the way described. For the defence, it was said that it was usual in the defendant's shop to wrap mixtures of coffee and chicory in a paper on which was written notice to the effect that there was chicory admixed. Mr. Hannay imposed a penalty of 40s. and costs.

Mr. Henry Crocker, grocer, also of Coombs-street, St. Luke's, was fined 20s. for having sold coffee adulterated with 5 per cent. chicory.

Butterine Prosecution :—

At the Portsmouth Police Court, Mr. Wm. Lang, of Russell-street, Landport, was summoned for selling to the prejudice of the purchaser an article which was not of the nature, substance, and quality demanded. Mr. Feltham defended. Inspector Bell, one of the officers under the Food and Drugs Act, said that on August 24 he went in plain clothes to the defendant's shop, and saw some fatty substance in a tub, resembling butter, and marked 1s. per lb. Pointing to it, witness said, "Give me half a pound of that butter?" Defendant served him, and after the purchase had been completed, he said he was going to have it analysed by the public analyst. Thereupon the defendant remarked, "You did not ask for butter, you only said, 'Give me half a pound of that?'" The inspector, however, was positive upon the point. The certificate of the public analyst, Dr. Sykes, showed that the sample was entirely composed of foreign fat. In cross-examination, the inspector admitted that there were three tubs standing together. He asked for a half pound out of one of the end ones. The centre one was marked 10d. per lb., and on this tub was a printed card with "Butterine" in letters about three quarters of an inch in length. These other tubs were priced in the same way as the one from which he purchased a sample. Mr. Lance (one of the Bench): But is it possible to get butter at 1s. a lb.? The Inspector: Oh yes, sir, you can get very good butter at that price. Mr. Lance: Well, I should very much like to. Mr. Feltham, for the defence, said his client sold nothing else but butterine in the shop, and the fact that the centre tub of the three was labelled "Butterine" was, he contended, a sufficient protection for the defendant. His version of the story was that the inspector simply pointed to the tub, and said "Give me a half a pound of that." As to the composition of butterine, Dr. Turner, the former medical officer of health, had said that butterine was more nutritious to the stomach than some kinds of butters. The magistrates, after consultation, said that, as there was a doubt in the case, the defendant would have the benefit of it, and be discharged.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No.	Name of Patentee.	Title of Patent.	Price.
1880			
4245	J. C. Stevenson	Treatment of Ores of Lead and Zinc	4d.
5350	J. H. W. Biggs	Manufacture of Salt from Brine or other Solution	1/4
5372	Ditto	Manufacture of Salt for Domestic and other Purposes	2/6
1881			
225	St. G. L Fox	Electric Lamps	6d.
298	C. Scheibler	Manufacture of Magnesia	4d.
331	Ditto	Manufacture of Sugar	4d.
375	A. Dupré & O. Hehner	Preparation of Banker's Cheques	4d.
386	W. R. Lake	Manufacture of Starch and Glucose or Grape Sugar	10d.
422	W. Weldon	Treating Mixed Solutions of Chlorate of Lime and Chlorate of Calcium	4d.
423	Ditto	Manufacture of Chlorate of Potash	4d.
424 & 425	Ditto	Manufacture of Chlorate of Soda	4d.
546	J. A. Kendal	Manufacture of Dinitro Benzole	4d.
560	J. H. Johnson	Manufacture of Sugar	4d.
701	A. M. Clark	Manufacture of Magnesia	4d.
715	J. G. Tongue	Electric Lamps	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; Physiological and Therapeutic Properties of Mineral Waters, by Dr. P. Killian.

THE ANALYST.

NOVEMBER, 1881.

SOCIETY OF PUBLIC ANALYSTS.

The next General Meeting of this Society will be held at Burlington House, on Wednesday, the 16th inst., at 8 o'clock.

ANALYSES OF GRAPE JUICES, AND OF VARIOUS SAMPLES OF UNFERMENTED AND OTHER WINES.

By J. Carter Bell.

My reason for these investigations was that the Salford inspector brought me some samples labelled "Pure Grape Juice," "Unfermented Wine," "Sacramental Wine," &c., &c., some of which I suspected were not genuine, and as I was unable to find any recent reliable data as to what grape juice really is, I determined to ascertain for myself; I therefore bought several samples of grapes and squeezed the juice from them myself. Other samples I obtained from Mr. Frank Wright, of London, who is well known in the temperance world as a maker of pure unfermented wines. He imports large quantities of grapes from which he presses the juice; some of the grapes were squeezed by him in my presence.

The following list gives the names of the pure grape juices operated on:—

1. Black English hot-house grapes. }
2. White English hot-house grapes. } Purchased in England, and juice expressed by myself.
3. Almeira, 1879. }
4. Do., 1880.
5. French Cluster, 1878. Chiefly used in the production of "Vin Ordinaire."
6. Portuguese Cluster, 1879. Purchased in England, and juice expressed in my presence.
7. Bordeaux, 1880. A mixed must, consisting of Carbenet Sauvignion, Malbec and Verdat Varieties.
8. Oporto, 1880. "The Bastardo," from the Alta Douro.
9. Pineau. (The Champagne grape). From the Cot d'or.
10. Folly Blanc. (Cognac grape).
11. Blanquette. }
12. Grenach, No. 1. } From the vineyards of Perpignan.
13. Grenach, No. 2. }
14. Granache. } From a vineyard in the vicinity of Tarragona.
15. Clairette. }
16. Congress. From vineland, New Jersey, U.S.
17. Madeira Videilho.
18. Madeira Tinta.

The following table gives the specific gravity; also the total acidity calculated as tartaric acid, and the ash from 100 c.c., and the percentage of ash which is soluble and insoluble in water; all results in percentages :—

No.	Specific Gravity.	Acid.	Ash.	Ash Soluble.	Ash Insoluble.	
1	1083	·70	·356	90·56	9·43	
2	1071	·60	·331	89·42	10·57	
3	1071	·60	·311	84·40	15·59	
4	1056	·70	·258	78·57	21·43	
5	1058	1·17	·273	76·32	23·68	
6	1078	·89	·252	88·09	11·91	
7	1079	·97	·298	56·65	43·34	
8	1088	·67	·261	72·79	27·20	
9	1065	1·12	·289	70·24	29·76	
10	1077	·75	·266	70·88	29·11	
11	1100	·60	·284	72·12	27·88	
12	1084	·75	·291	68·77	31·22	
13	1076	1·61	·289	63·51	36·48	These samples had undergone some fermentation, and contained a considerable quantity of vol. acid.
14	1096	1·50	·305	67·41	32·59	
15	1102	·90	·348	63·95	36·05	
16	1070	·75	·395	74·74	25·26	
17	1107	·75	·267	59·27	40·73	
18	1101	·60	·318	63·99	36·00	

All the above samples, except 13 and 14, were unfermented. Fermentation had been arrested by the addition of salicylic acid, or by raising the juice immediately upon expression to the boiling temperature. The last thirteen musts in this list were pressed on their respective vineyards. They were not submitted to analysis until six months after their arrival in this country. Samples Nos. 4, 7, 8, 14, 15 and 16, had deposited varying quantities of potass bitartrate in the stock vessels. In these cases the acidity, total ash, and soluble ash given in the above tables are therefore somewhat below what would have been yielded by freshly expressed and filtered juices.

On comparing these results it will be observed that in no sample examined was there a total absence of those inorganic constituents which are frequently regarded as essential to the constitution of the grape. The variations in their proportions is, however, most striking. Confining to the proportions of total, and of soluble and insoluble ash, it will be seen that the total ash ranges between ·258 per cent. and ·395 per cent.; and it is remarkable that each of these extremes was furnished by a juice which had stood in the stock vessels for several months, and had undoubtedly deposited a considerable quantity of its mineral constituents. The extreme of variation in the proportion of soluble ash is 56·65 to 90·56 per cent. of the total ash; and of the insoluble ash the variations are from 9·44 to 43·34 per cent. of the total ash. These variations, when viewed from the point of view of the professional analyst, are instructive in two or three particulars. It is obvious that in attempting to determine whether a particular sample is or is not pure juice of the grape regard must be had both to the species of grape and to the time when the juice was expressed, whether old or recent. The consideration of age would not, however, apply in the case of a sample of which it is admitted that it contains a large admixture of water, as in the case tried at Salford. In that case it was admitted by the defence that the sample consisted of one-fifth grape juice, and four-fifths water. Such a mixture does not deposit the salts of the grape, but only some light flocculi which contain merely infinitesimal quantities of inorganic constituents.

Table giving the number of grains of chief constituents of ash from one gallon of grape juice from each of the above samples :—

No.	Total Ash.	Potash.	Soda.	Chlorine.	Sulphuric Acid.	Phosphoric Acid in combination with Alkalies.	Lime.	Magnesia.	Phosphate Iron.	Alumina Phosph.	Phosphate of Lime.	Silica.
1	249·20	135·21	8·71	1·31	26·21	18·16	1·62	2·41	·12	·21	18·12	·21
2	231·70	119·31	7·61	2·00	23·14	10·12	1·82	3 01	·20	·12	22·35	·20
3	218·12	108·3	9·70	1·47	25·34	13·56	2·10	3·75	·14	·35	25·00	·70
4	181·16	88·16	3·58	·65	18·42	10·50	6·19	4·25	·18	·45	18·91	·60
5	191·03	92·52	0·56	1·20	22·48	4·21	4·04	3·89	1·48	·98	30·52	·31
6	176·33	88·96	2·95	2·80	19·71	10·12	3·48	3·87	1·88	·77	10·50	·28
7	205·10	69·55	2·40	3·10	14·70	12·06	12·11	8·76	·47	·75	49·76	·17
8	182·70	74·62	10·01	1·70	13·37	1·12	13·21	9·31	·68	1·90	10·43	·63
9	202·30	87·64	2·07	2·07	14·26	7·06	12·55	3·25	2·64	1·35	32·50	·35
10	186·20	76·72	1·15	·71	9·86	·42	26·60	8·40	1·96	2·24	9·24	·30
11	219·24	94·15	3·62	1·65	16·34	11·40	11·20	10·80	1·23	1·54	35·00	·15
12	203·56	79·00	6·21	2·03	16·02	4·58	11·20	17·36	1·12	1·68	26·88	·40
13	202·38	71·40	4·34	3·57	18·43	3·64	12·32	22·68	3·40	3·71	30·24	·84
14	213·92	81·76	7·50	3·20	23·62	2·99	10·00	9·22	1·12	·84	49·00	1·19
15	243·90	97·35	5·43	3·05	24·48	1·25	13·16	31·36	4·20	6·44	21·56	2·46
16	241·85	107·20	20·62	1·01	10·65	17·02	10·71	7·00	·94	·63	17·32	·70
17	186·90	59·60	3·34	1·04	25·56	1·59	10·64	18·69	·70	1·22	37·61	1·22
18	222·60	80·95	9·10	2·36	20·78	2·52	7·95	11·94	1·29	·98	48·01	·87

Chief constituents in 100 parts of ash, calculated in percentages on the total ash :—

No.	Potash.	Soda.	Chlorine.	Sulphuric Acid.	Phosphoric Acid with Alkalies.	Lime.	Magnesia.	Iron Phosphate.	Alumina Phosphate.	Lime Phosphate.	Silica.
1	54·285	3·493	·525	10·518	7·284	·650	·966	·048	.084	7·268	·084
2	51·434	3·051	·862	9·975	4·362	·784	1·297	·086	·051	9·635	·086
3	49·646	10·539	·673	11·614	6·219	·962	1·720	·064	·160	11·424	·320
4	48·660	1·979	·363	10·170	3·038	3·418	2·349	·104	·251	10·444	·332
5	48·418	·293	·626	11·766	2·198	2·113	2·036	·776	·512	15·970	·164
6	50·086	1·663	1·587	11·179	3·445	1·958	2·179	1·052	·433	5·911	·157
7	33·170	1·148	3·390	7·189	5·756	5·410	4·178	·225	·359	23·73	·131
8	39·980	5·360	·927	7·319	·596	7·080	4·990	.364	1·020	5·57	·337
9	42·418	1·003	1·026	7·051	3·419	6·078	1·573	1·227	·653	15·72	·169
10	40·354	·607	·383	5·294	·219	13·991	4·418	1·030	1·178	4·860	·162
11	46·426	1·784	·828	8·221	5·623	5·521	5·324	·606	·760	17·255	·076
12	38·789	2·910	1·001	7·868	2·160	5·260	8·180	·526	·789	12·640	·189
13	34·557	2·100	1·760	9·112	1·762	5·962	10·977	1·640	1·795	14·636	·406
14	37·527	7·344	1·501	11·062	1·377	4·590	4·231	·514	3·850	22·491	·546
15	39·039	2·180	1·251	10·040	·503	5·277	12·575	1·684	2·582	8·645	·988
16	37·948	7·292	·292	3·137	6·026	3·791	4·980	·332	·220	3·131	·248
17	31·233	1·750	·559	13·678	·832	5·575	9·793	·367	·642	19·710	·641
18	35·620	6·283	1·060	9·336	1·112	3·498	5·253	·567	·431	21·124	·385

The following are samples of unfermented and other wines brought and obtained from various places :—

No. 1.—Label on bottle : " Bell's unfermented juice of the vine, pure uncoloured virgin fruit of the vine, nutriment of the grape without the irritant."

No. 2.—" Unfermented wine, sherry, manufactured from the juice of the grape."

No. 3.—" Unfermented wine, port, manufactured from the juice of the grape."

Comparing the analyses of the ashes of the above three " Wines," as given in the succeeding tables, with the ash from pure grape juice, there will be no difficulty in deciding that these three samples are not genuine grape juice.

No. 4.—" ——— new wine," stated on the label to be "the best unfermented wine introduced, the guaranteed fruit of the vine, free from alcohol." This wine contained 1½ per cent. of proof spirit; it also gave a very low ash.

No. 5.—" Purest unfermented wine for the administration of the Lord's Supper, carefully bottled by ———. The selected wine of the temperance fraternity." This wine is alleged to be unfermented, and to consist of the juice of the grape boiled down to one-fifth of its original bulk in order to deprive it of its spirit. The low specific gravity and the proportion of ash prove that it has not been boiled down. The presence of 30 per cent. of proof spirit also stands as a witness to prove the absence of boiling.

No. 6.—" Pure and genuine unfermented fruit of the wine; ———." This wine contained 2½ per cent. of proof spirit.

No. 7: " Castle Tent, bottled and guaranteed by ———." The label represents this to be an unfermented sweet wine, with only the small amount of spirit necessary for its preservation. This wine contained 14 per cent. of proof spirit.

No. 8.—Castle Rota Tent. This is similar to No. 7.

No. 9.—" Unfermented wine, free from alcohol and unintoxicating, preserved *in vacuo* by ———. This wine is prepared from grapes, specially imported from Andalusia, Burgundy and the Medoc, for this purpose; it is guaranteed to be the true fruit of the vine." This sample was bought from a shop in the Borough of Salford by the Salford inspector. It did not contain alcohol, and the analysis of the ash is similar to the analysis of pure grape juice ash.

No. 10.—Greek wine from the Island of Scio, " unfermented."

No. 11.—White grape wine, fermented, from the Island of Scio.

No. 12.—Deidesheimer, pale alcoholic wine.

No. 13.—Diedesheimer Aucolee, a pale alcoholic wine.

No. 14.—Italian juice, from Palmi, Calabria.

Specific gravity of the wines; also the total acidity calculated as tartaric acid, and the ash from 100 cc., and the percentage of ash which is soluble and insoluble in water :—

No.	Specific Gravity.	Acid.	Ash.	Ash Soluble.	Ash Insoluble.
1	1100	·67	·083	30 30	69·69
2	1004	·61	·030	33·33	66·66
3	1107	·59	·034	38·23	61·76
4	1087	·56	·190	76·84	23·15
5	1015	·37	·261	69·77	30·27
6	1071	1·125	·342	61·40	38·50
7	1125	·75	·593	75·00	24·96
8	1158	·75	·570	69·80	30·17
9	1078	·67	·290	74·48	25·52
10	1047	·72	·368	75·80	24·20
11	990	·71	·158	70·58	29·41
12	995	·84	·185	62·59	37·45
13	996	·60	·194	54·54	45·11
14	1096	·78	·347	74·94	25·05

Table giving the number of grains of chief constituents of ash from one gallon of wine :—

No.	Potash.	Soda.	Chlorine.	Phosphoric Acid united to Alkalies.	Sulphuric Acid.	Lime.	Magnesia.	Iron Phosphate.	Alumina Phosphate.	Lime Phosphate.	Silica.	Oxide of Copper.
1	5·04	2·30	·14	·104	9·00	1·734	·216	·190	·482	2·219	·434	·864
2	1·97	2·31	·14	·104	8·56	1·596	·378	·240	·474	2·303	·476	·945
3	3·30	1·67	·14	·228	9·40	1·05	·67	·29	·942	3·606	·560	·945
4	58·10	4·55	2·80	4·27	8·542	9·80	7·77	2·25	·690	1·120	1·12	..
5	64·89	11·12	9·80	7·12	30·710	14·49	9·839	·60	1·850	10·92	·875	..
6	89·11	5·10	4·34	7·12	26·60	25·90	17·516	..	2·980	·77	·84	..
7	148·62	10·69	18·20	20·809	83·51	17·22	18·014	2·83	5·570	39·55	1·12	..
8	135·24	17·94	29·12	21·985	68·88	15·40	16·187	2·83	5·430	53·90	1·61	..
9	93·92	1·50	1·32	5·210	23·12	5·52	4·21	1·51	1·000	33·67	·40	..
10	85·05	23·38	18·54	41·37	16·08	7·175	16·60	1·283	1·960	23·49	·28	..
11	47·32	5·62	1·359	8·43	12·68	3·191	3·53	·401	·418	11·923	1·106	..
12	61·81	1·20	2·128	5·884	15·827	3·693	3·822	·945	1·260	23·975	·735	..
13	50·12	2·13	2·786	10·405	11·216	7·977	5·083	·641	·933	21·305	·105	..
14	126·70	3·01	3·547	30·141	16·613	9·035	5·976	2·401	2·429	28·385	1·365	..

Chief constituents in 100 parts of ash :—

No.	Potash.	Soda.	Chlorine.	Sulphuric Acid.	Phosphoric Acid.	Lime.	Magnesia.	Iron Phosphate.	Alumina Phosphate.	Lime Phosphate.	Silica.	Copper Oxide.
1	21·808	9·952	·605	38·943	·450	7·503	·934	·822	2·085	9·601	1·877	3·651
2	9·401	11·024	·666	40·683	·495	7·597	1·800	1·142	2·216	10·962	2·265	4·508
3	13·876	7·030	·588	39·513	·957	4·410	2·814	1·218	3·956	15·523	2·352	3·969
4	43·663	3·419	2 104	6·419	3·208	7·364	5·845	1·690	·518	·841	·841	..
5	35·501	6 088	5·361	16·801	3·900	7·917	5·383	·328	1·002	5·974	·478	..
6	37·208	2·129	1·812	11·105	2 970	10·813	7·313	..	1·244	·321	·350	..
7	35·887	2·576	4·382	20·109	·676	4·346	1 095	·681	1·341	9·523	·270	..
8	33·877	4·594	7·394	17·254	5·507	3·857	4·054	·708	1·360	13·501	·403	..
9	46·246	·738	·650	11·384	2·565	2·718	2·072	·743	·492	16·579	·196	..
10	31·233	1·750	6·770	13·678	·832	5·575	9·793	·366	·642	19·710	·641	..
11	42·763	5·080	1·228	11·467	7·617	2·883	3·196	·443	·377	10·779	·999	..
12	47·655	·925	·162	12·197	4·533	2·847	2·946	·728	·971	18·484	·566	..
13	36·888	1·567	2·044	8·250	7·654	5·865	3·738	·471	·684	15·680	·077	..
14	52·073	1·237	1·455	12·387	6·826	3·713	2·456	·986	·998	11·664	·561	..

In several instances the quantity of liquor at my disposal was very small, thus preventing me from making duplicate analyses.

ANALYSES OF LIEBIG'S EXTRACT OF MEAT, AND OF AN IMITATION OF THE EXTRACT.

By C. Estcourt, F.I.C., F.C.S.

A few months ago I received a sample pot, duly labelled, &c., purporting to contain the genuine Extractum Carnis Liebig, which I was informed had been imported into this country from Italy. I was also informed upon good authority that the imitation was made principally from horse flesh, that it had been offered at a slightly reduced price, and had been purchased in considerable quantities by one or two large establishments in the city of Manchester.

Being of opinion that the comparative analyses of both the genuine and the imitation might be of some value to Public Analysts in other towns where the article was offered, I obtained from a large firm of wholesale druggists here, a sample of undoubtedly genuine

Liebig's Extract to compare with the imitation. The latter in general get-up, labels, signature, and every detail would inevitably deceive anyone who merely judged by the appearance of the article.

	PER-CENTAGE COMPOSITION.	
	Imitation.	Genuine
Total Solid Matter	82·0	88 0
Water	18·0	12·0
Fat	1·0	0·0
Total Ash	23·10	21·31
Ash Insoluble in Water	1·32	1·48
Sodium Chloride	14·21	8·12
P_2 O_5 Phosphoric Anhydride, in Soluble Phosphates	1·765	4·627
HSO_4 Sulphuric Acid, in Soluble Sulphates	0·451	0 606
Akalinity of Soluble Ash, expressed as NaHO	2·401	2·160

It will be observed that the main differences between these two samples are due to the excess of NaCl and the deficiency in Phosphoric, which, together with the presence of fat, characterise the imitation sample.

NOTE ON WILLIAMS'S NITROGEN PROCESS.

By Thos. P. Blunt.

Williams's zinc couple method may be conveniently and accurately worked without distillation, in the case of any water, by adding oxalic acid to a double quantity of the sample, dividing, and using one portion, simply cleaned by subsidence in a stoppered bottle, as a comparison liquid for testing against the other, treated with the zinc couple in the usual manner. Of course, where dilution is used it must be carried out on each portion. The advantages of this modification are two-fold—(1) an equal turbidity is produced by Nessler solution in both samples, and (2) where the oxalic acid has contracted traces of ammonia, as is so often the case in a laboratory, the error introduced is corrected·

QUALITATIVE ANALYSIS OF A SOLUTION OF "CITRATE OF MAGNESIA," SOLD BY A NEW YORK MANUFACTURER.

By Edo Claassen, Cleveland.

Having found it difficult to prepare a solution of citrate of magnesia that will remain clear and not precipitate, and further, that the solution of citrate of magnesia sold by a certain firm always possesses these properties, I undertook some time ago to examine the same in regard to the presence of magnesia and citric acid. The usual analytical method of destroying by evaporation and subsequent ignition all organic substances, in order to determine the fixed bases, was employed by me in this case. I, therefore, evaporated about 4 oz. of the liquid in a silver dish to dryness, ignited the residue perfectly, and mixed the same with water and as much hydrochloric acid as was necessary to give the solution an acid reaction. The solution was then separated from a small quantity of coke, and a part of it was mixed with ammonia in excess, and with solutions of ammonium chloride and sodium phosphate. No precipitate was formed, not even after several hours' standing. Magnesia was not present. The rest of the liquid was then tested for the presence of potassium and sodium, and only the last one found present. Another part of the original so-called "citrate-of-magnesia solution" was now tested in regard to the acids that might be combined with the sodium, and it was ascertained that, besides a little sulphuric acid, no other acid besides tartaric was in the liquid. The so-called solution of "citrate of magnesia" was, therefore, nothing but a solution of sodium tartrate, and it could now at once be explained why this solution always keeps well, and never forms a deposit.—*New Remedies.*

ON THE PURITY OF COMMERCIAL IODIDE OF POTASSIUM.

BY O. KASPAR.

THE method which is employed by the author to determine the per-centage of pure iodide is very simple, and has the additional advantage that it is not interfered with by the presence of carbonate, bromide and chloride. It depends upon the following reaction:—

$$HgCl_2+4KI = 2KCl+HgI_2.2KI.$$

Four molecules of iodide of potassium are, therefore, exactly decomposed by 1 molecule of corrosive sublimate, so as to form a soluble double salt. If, now, an excess of corrosive sublimate is added, the double salt is again decomposed and mercuric iodide is separated.

$$HgCl_2+HgI_2.2KI = 2KCl+2HgI_2.$$

As soon as this separation begins, the reaction is terminated.

The normal solution of corrosive sublimate is prepared by dissolving 2·71 grams of the salt in sufficient water and diluting to 100 cubic centimetres. 1 cc. of the solution, according to the above equation, indicates 0·06643 gram of iodide of potassium. When using the process, 10 grams of the iodide of potassium are dissolved in 50 grams of water, and 5 cubic centimetres of this solution are used at a time for trituration. This quantity is run into a beaker, placed on a sheet of white paper, and the above volumetric solution is allowed to flow in from a burette divided in $\frac{1}{10}$, until a permanent reddish yellow opalescence ensues. Just before this occurs, the liquid itself assumes a reddish-yellow colour, which may be regarded as a sign of the approaching end of the reaction. It is best to prepare the solution of the sublimate each time fresh.

The author has examined many commercial samples of iodide of potassium by this method and has found the per-centage of the true salt to vary between 88 and 99·6 per cent. He considers that the commercial salt should contain *at least* 96 to 97 per cent. of pure salt.—*Schweiz. Woch. f. Pharm.*

LEAD IN BROMIDE OF POTASSIUM.

MASCHKE has found bromide of potassium in the market which is contaminated with lead. It is soluble to a clear liquid only after addition of an acid; the larger crystals are remarkable by their transparency and their form, being a compound of octoeders and cubes. In testing for lead, sulphuric acid cannot be used, since the resulting sulphate of lead is soluble in bromide of potassium. But if hydrosulphuric acid or sulphide of ammonium is used, no doubt can arise.—*Pharm. Zeit.*

THE ADULTERATION OF BALSAM OF PERU.

BY ALFRED SENIOR, M.D., F.C.S.

THE adulteration of balsam of Peru has been practised to a large extent and with some degree of success, for several years past, principally in the north of Germany. The adulterants employed are rosin, gum benzoin liquefied with a little alcohol, storax, copaiba, and in some cases castor oil. In a communication to the *Pharmaceutische Zeitung* (xxx., 222,) Prof. Fluckiger deals with the problem of the examination of Peru Balsam for impurities. Pure balsam of Peru is a mixture of about two-thirds, as a maximum, of benzyl cinnamate or cinnameni, and one-third, as a minimum, of a brownish black resin; it also contains about four per cent. of cinnamic acid, besides small quantities of other substances. The specific gravity determined at 15° C. varies from 1·138 (minimum) to 1·147 (maximum), and inasmuch as all the adulterants are lighter than the pure balsam, the specific gravity of the sample is an important item. Samples should be regarded with suspicion when the specific gravity is below 1·14, or perhaps as the extreme limit, 1,138. Among other physical characteristics, the consistency of the specimen is important; adulterated samples usually yield "thick, thread-like attenuated drops."

The benzyllic cinnamate is easily extracted from the balsam by shaking with three times its weight of carbon disulphide, the solution, which, if the balsam be pure, is nearly colourless, being evaporated and the residue weighed. The quantitative determination of this constituent is not always of much value, owing to the varying amount of this substance contained in different specimens of balsam: in some cases, however, it is valuable, the effect of adulterants being to increase the weight of what ought to be nearly pure benzyllic cinnamate. The substance remaining after the treatment with carbon disulphide is the rosin, the weight of which should be nearly two-fifths, or at any rate exceed one-third, of the original weight of the balsam operated upon. If adulterants have been added, the weight will be less than this. For the estimation of the cinnamic acid, the author proposes the following method: fifty parts of balsam are boiled with a mixture of twenty parts of lime and five hundred parts of water, for two hours, care being taken to replace any water which evaporates during the process. At the end of this time the boiling solution is filtered, the substance remaining on the filter being twice washed with two successive two hundred parts of boiling water. In this way all the cinnamic acid is obtained in solution as calcium cinnamate. The filtrate and washings are now evaporated to two hundred parts, treated with excess of hydrochloric acid and allowed to stand for some time. The cinnamic acid which will have separated in crystals, is collected, and after pressing between bibulous paper, dried partially by exposure to the air and finally on the water-bath. The weight ought to equal from three to four per cent. of the original sample. The determination of this constituent, however, is only of importance when considered in relation to the amounts of the other substances present. After the above treatment there remains upon the filter a mixture, the condition of which affords an important indication of the purity of the balsam—pure samples yield a "soft, pliable mass;" when adulterated the mass is more or less hard. So important does Prof. Fluckiger consider this indication that he proposes a special test based upon it, for the determination of the general purity of balsam of Peru. If two parts of the balsam are triturated with one part of slacked lime a "soft, kneadable or somewhat pliable, tenderly divisible mass" is obtained if the balsam is pure; in fact the mass presents exactly the characteristics that one would expect from such a mixture. Where, however, storax, alcoholic extract of gum benzoin, rosin or copaiba were added to the extent of ten per cent., the mass became solid, hard and unkneadable. If this test is found by other experimenters to answer with all genuine specimens of balsam of Peru, Prof. Flückiger suggests that as a test of purity, it should be ordered that "ten drops of Peru balsam shall furnish with four grammes of slacked lime a mixture which remains soft." The only case where this test could not be applied is when castor or other fatty oils have been used as adulterants. These substances, however, would be revealed by heating the lime mixture, when they would be rendered evident by their odour and would also be detected by the treatment with carbon disulphide.

GERMLESS MAIZE.

The importance of maize to the distiller and to the brewer is becoming generally recognised in this country, but it requires to be degerminated to be used to the highest advantage. The removal of the germ greatly enhances the value of the maize for the purposes of the distiller, and the degerminating process promises to be exceedingly valuable as a means of preparing the grain in question. By degermination its value is increased, by increasing the proportion of starch, so as to yield, it is said, 5·26 lbs. more of proof spirit for every 100 lb. of maize employed. By the reduction of the proportion of oil to something like that contained in barley malt, and by reducing to some extent the amount of nitrogenous compounds, the spirit from germless maize is, it is found, not only larger in quantity, but better in quality than that from the whole grain, while the extracted germs, though detrimental in distilling, are, it is said, more valuable for feeding purposes than the article in a whole state. The germs contain a larger amount of oil than linseed cake, while the nitrogenous matter, so valuable as a flesh-former, is largely increased by the degerminating process. Messrs. Muir and Son are said to be working the process upon a large scale, and to the entire satisfaction of distillers, brewers, and starch makers, who are their largest customers. As an article of feed for horses, when reduced with hay, chaff, or straw, the germ, as extracted by the process of the Messrs. Muir, we understand, commands a high price, ratifying the statement made by Mr. Gladstone in his budget speech respecting the enhanced value of the cereal in its degermed state for distilling, brewing, starch-making, and for feeding purposes. Distillers as a class are not less alive to their interests than any other class of manufacturers, and there may be a good future in store for the Muir process. —*Miller.*

Displacement of the Sodium Base in Sodium Chloride by Copper Hydrate.—Copper hydrate in a moist state possesses the singular property of liberating a certain quantity of alkali, if it is brought in contact with certain saline solutions, such as sodium and potassium chloride, potassium bromide, sodium sulphate, &c. The displacement of the alkali takes place even at temperatures as low as 4° and 5° C. If copper hydrate, well washed and moist, is added to a solution of sodium chloride of 10 per cent., the liquid in a few minutes acquires an alkaline reaction, which increases on standing. Meantime the hydrate is converted into a pale green powder containing chlorine. Moist copper carbonate acts in a similar manner.—*Comptes Rend.*

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in October, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Oct. 11	pale blue green	none	1·91	trace	·255	·0029	·0078	none	.0080	22·0°	6·4°	31·80	satisfactory	Wigner & Harland.
New River	„ 15	clear	none	1·14	trace	·210	·0021	·0028	0120	·0260	15·0°	15·0°	18·76	satisfactory	B. Dyer.
East London ..	„ 11	p. g. yel. s. turb.	none	1·49	trace	·199	·0026	·0067	none	·0840	14·9°	5·3°	23·20	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	„ 8	c. v. p. yellow	none	1·24	trace	·150	none	·0042	·0300	·0560	14·5°	3·5°	20·10	satisfactory	J. Muter.
West Middlesex	„ 18	yellow green	none	1·17	trace	·138	·0020	·0056	·0380	·0620	13·1°	2·4°	19·35	satisfactory	O. Hehner.
Grand Junction	„	pale yellow	none	1·22	trace	·161	·0010	·0069	·0031	·0840	14·1°	3·9°	20·00	satisfactory	A. Wynter-Blyth.
Lambeth	„ 8	c. v. p. yellow.	none	1·49	trace	·160	none	·0042	·0308	·0561	14·5°	3·5°	20·16	satisfactory	J. Muter.
Chelsea	„ 12	c. p. grnsh. brn.	none	1·16	trace	·140	·0010	·0080	·0320	·0780	13.5°	2·5°	19·04	satisfactory	A. Dupré.
Bath	Oct. 14	clear f. blue	none	1·08	none	·150	none	·0001	none	none	17·5°	4·5°	22·72	none	J. W. Gatehouse.
Bradford	„ 19	s. opq. pty. yell.	none	·60	none	none	none	·0049	·0200	·1460	4·2°	3·9°	7·80		F. M. Rimmington.
Birmingham ..	„ 4	v. turb. grsh. yel.	none	1·19	trace	·092	·0020		·0140	·1550	9·1°	5·5°	17·25	siliceous and veg. matter	A. Hill.
Bolton........	„ 10	v. turbid yellow	none	·45	none	·032	·0019	·0056	·0285	·0485	3·2°	3·0°	6·30	clayey subs. & veg. mtter.	W. H. Watson.
Brighton......	„ 11	pale blue green	none	2 06	none	·385	·0011	·0048	none	none	12·6°	4·0°	23·80	vegetable debris	Wigner & Harland.
Bristol........	„ 10	greenish	none	·90	none	·055	·0010	·0063	·0148	·0468	7·7°	2·2°	16·80	algæ & sand	F. W. Stoddart.
Bury (Lan.) ..	„ 8	s. turbid yellow	s. mossy	·90	none	·042	·0040	·0095	·0188	·0324	4·5°	4·4°	8·63	mineral matter veg. deb.	W. H. Watson.
Cambridge	„ 15	c. pale blue	none	1·40	traces	·411	none	·0016	·0044	·0131	17·5°	6·0°	24·50	satisfactory	J. West Knights.
Canterbury	„ 17	pale blue	none	1·47	none	·338	·0006	·0005	·0040	·0120	5·2°	4·2°	9·24	slight	S. Harvey.
Croydon	„ 20	f. green	none	1·05	trace	·324	·0030	·0020	·0072	·0072	16·0°	7·5°	22·60	none	C. Heisch.
Darlington	„ 14	s. turb. yel. grn.	s. peaty	·56	traces	none	none	·0098	·0153	·2520	6·4°	3·0°	8·96	movg. orgnsms. min. mtr.	W. F. K. Stock.
Edinburgh	„ 11	yellowish	none	·67	none	trace	·0032	·0072	·0160	·1184	4·7°	3·9°	6·40	none	J. Falconer King.
Exeter	Sept. 23	f. brnsh. yellow	none	·84	trace	·077	·0007	·0039		·0483	2·8°	2·8°	7·00		F. P. Perkins.
Grantham	Oct. 16	l. brown opaque	slight	·99	trace	·438	·0015	·0115	·0684	·1177	14·0°	5·0°	23·10	diat., conferv., vortic., &c.	A. Ashby.
Hastings	„ 17	pale blue cloudy	none	5·30	trace	·190	·0042	·0035	·0014	·0084	6·0°	3·5°	22·20	none	H. F. Cheshire
Ipswich	„ 12	c. colourless	none	2·12	trace	·395	·0026	·0044	none	·0080	24·0°	4·5°	34·62	satisfactory	J. Napier.
King's Lynn ..	„ 17	light brown	weedy	1·49	traces	·082	·0005	·0070	·0268	·3002	10 8°	4·5°	18·90	animalculæ veg. debris	W. Johnstone.
Leamington ..	„ 13	greenish	none	1·47	none	none	·0028	·0014	none	none	27.8°	14·0°	30·80	vegetable matter	A. Bostock Hill.

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									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Leicester......	Oct. 20	s. yellow	none	1·12	traces	·075	·0011	·0023	·0030	·0730	7·7°	5·4°	16·33	vegetable debris	W. L. Emmerson.
Liverpool	„ 13	yellow brown	s. peaty	1·08	traces	·077	·0 028	·0056	·0462	·0691	5·3°	4·7°	8·40	amorphous matter	A. Smetham.
Maidstone—															
Wtr. Company	„ 13	yell. grn. s. turb.	none	2·33	traces	·860	none	·0014	·0260	·0364	17·9°	6·6°	33·60	satisfactory	M. A. Adams.
Public Conduit	„ 13	c. colourless	none	2·14	traces	·860	none	·0003	·0056	·0156	17·5°	6·2°	32·13	satisfactory	M. A. Adams.
Manchester....	„ 19	s. turb. f. yellw.	none	·73	none	none	·0031	·0065	·0431	·1835	2·0°	2·0°	4·84	s. mineral	W. Thomson.
Newark	„ 14	turbid, greenish	none	1·43	trace	·055	·0009	·0039	·0191	·0455	17·0°	9·0°	35·81	amorphous matter	A. Ashly.
Newcastle-on-Tyne......	„ 10	f. yellow	none	·76	trace	·040	trace	·0090	·0770	·1220	16·0°	5·0°	18·90	satisfactory	J. Pattinson.
Norwich	„ 8	p. grnsh. yellow	none	1·90	traces	·049	traces	·0060	·0366	·0680	13·0°	4·2°	16·40	satisfactory	W. G. Crook.
Nottingham ..	„ 14	p. blue green	none	2·76	none	1·840	none	·0070	none	·0100	17·6°	12·6°	38·40	veget. deb. earth anim.	Wigner & Harland
Portsmouth ..	„	s. turbid	none	1·12	trace	·190	trace	·0031	none	none	13·8°	2·0°	19·50	decayed veg. diatoms	W. J. Sykes.
Reading	„ 4	f. yellow	none	1·10	trace	·155	·0007	·0049	·0030	·0560	15·1°	4·7°	19·20	satisfactory	J. Shea.
Rochdale	„ 17	v. f. green	none	·60	none	none	·0007	·0014	·0007	none	2·2°	2·0°	3·20	satisfactory	T. A. Collinge.
Rugby	„ 1	f. turb. colourless	none	1·42	v. h. traces	·092	·0017	·0168	·0337	·0840	20·0°	10·0°	22·40	veg. debris, desmids, diat.	A. P. Smith.
Salford	„	yellowish	none	·60	none	none	·0014	·0021	·0257	·0392	3·0°	2·5°	3.50	none	J. Carter Bell.
Shrewsbury ..	„ 7	c. colourless	none	1·45	traces	·296	·0005	·0010	·0030	·0070	23·0°	7·0°	25·00	none	T. P. Blunt.
Southampton..	„ 19	f. grnsh. yellow	none	·77	h. trace	·480	·0028	·0049	·0290	·0990	12·6°	4·6°	18·60	satisfactory	A. Angell.
Swansea	„ 14	clear	none	·80	trace	none	·0007	·0063	·0020	·0040	1·5°	1·5°	3·71	none	W. Morgan.
Whitehaven ..	„ 6	c. f. green	none	·34	traces	·007	none	·0017	·0100	·0180	·4°	·4°	1·87	satisfactory	A. Kitchin.
Wolverhampton	„ 10	s. yellow	none	1·33	traces	·084	none	·0042	·0201	·0389	13·7°	6·2°	20·86	diatoms, vegetable debris	E. W. T. Jones.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v. s., very slight.

ERRATA.—In the September Table the Nottingham Chlorine should have been 1·49 instead of ·149; Reading Chlorine should have been 1·10 instead of ·11.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO WIGNER'S VALUATION SCALE, OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of those public water supplies reported on this month from January to June, and the valuation of the July, August, September and October waters.

	Average to June.	July.	August.	Sept.	October.
London—					
Kent	30	27	20	27	29
New River	26	17	17	21	24
East London	32	39	20	28	35
Southwark and Vauxhall	34	28	31	27	30
West Middlesex	30	24	29	39	33
Grand Junction	30	23	25	30	31
Lambeth	37	29	31	26	33
Chelsea	30	26	32	36	37
Bath	12	19	20	..	13
Birmingham	33	37	26	29	36
Bolton	..	17	19	17	28
Bradford	53	58	59	44	36
Brighton	24	23	25	21	22
Bristol	22	27	..	30	29
Bury	..	35	24	24	30
Cambridge	28	26	22	21	22
Canterbury	17	22	16	12	15
Croydon	27	30	..	..	22
Darlington	33	39	96	50	74
Derby	18	13	..	..	..
Dublin	23	..	13	..	..
Edinburgh	28	21	20	24	31
Exeter	20	16	23	23	18
Grantham	27	..	32	..	70
Hastings	..	20	25	..	27
Huddersfield	23	26	28	..	..
Ipswich	27	30	30	..	28
King's Lynn	94	110	48	110	84
Leamington	26	..	26	..	24
Leeds	35	28	22	..	..
Leicester	42	24	26	28	25
Liverpool	36	29	41	47	37
Maidstone Water Company	39	34	30	31	38
,, Public Conduit	36	28	25	27	31
Manchester	22	17	29	28	49
Newark	39	46	41	..	33
Newcastle-on-Tyne	37	40	43	68	57
Norwich	36	49	36	33	34
Nottingham	39	46	38	42	62
Plymouth	29	..	..	28	..
Portsmouth	30	22	26	27	24
Reading	25	20	34	23	25
Rochdale	9	7	9	..	5
Rugby	41	..	..	46	69
Salford	18	14	21	21	15
Sevenoaks	20	..	..	..	..
Shrewsbury	23	..	17	19	21
Southampton	43	..	40	40	40
Sunderland	25	27	..	..	..
Swansea	16	14	19	15	12
Tunbridge Wells	..	..	..	35	..
Warwick	34	34	..	10	..
Whitehaven	9	17	14	10	10
Wolverhampton	46	39	32	15	33

Owing to considerations of space we have omitted from this table those places as to which we have published no analyses during the past four months.

In the case of the metropolitan waters, the average valuation of the supplies for October is 2·2 higher than the valuation for September, which was itself 3·5 higher than that for August, the average valuation for October being 31·5, while that for the first six months of the year was 31·2. The increased valuation is tolerably fairly distributed among the different companies, except the West Middlesex, which shows a considerably decreased figure in oxygen absorbed.

All the samples are, however, still well within the limits of first-class water, and quite fit for a public water supply.

Among the provincial supplies reported on this month, the most pure are Rochdale, with a valuation of 5; Whitehaven, 10; Swansea, 12; Bath, 13; Canterbury and Salford, 15 each; and Exeter, 18. In most of these cases there is a slight but quite perceptible improvement upon last month's reports.

In the case of Whitehaven the figure of last month's valuation should have been 10 instead of 30.

Following these best waters, we have Shrewsbury with a valuation of 21; Brighton, Cambridge and Croydon, 22 each; Leamington and Portsmouth, 24 each; Leicester and

Reading, 25 each; Hastings, 27; Bolton and Ipswich, 28 each; Bristol 29, and Bury 30. There are comparatively few changes of note in these figures, the most important change being probably that of Bolton, where a considerable increase on the proportion of oxygen absorbed has increased the valuation from 17 to 28.

The valuations of Bradford, King's Lynn, Liverpool and Newcastle show an improvement over the results of last month; while on the other hand the analyses of the waters from Darlington, Edinburgh, Grantham, Maidstone, Manchester, Nottingham, Rugby, and Wolverhampton give less satisfactory indications.

On the whole the general autumn and winter deterioration in the character of the supplies is making itself shown all over the country.

OCCURRENCE OF ARSENIC AND VANADIUM IN CAUSTIC SODA.

Since caustic soda is no longer exclusively made from crude soda and lime, but is also produced directly from red liquor, the product is often contaminated with undue proportions of chlorides, sulphates, carbonates, even nitrites, and sometimes cyanogen compounds. The author has now also met with arsenic and vanadium in caustic soda. The latter impurity may be disregarded, being rare and very minute; but the former is more serious. A sample of this caustic soda, dissolved in dilute sulphuric acid, and the solution tested directly in Marsh's apparatus, yielded a strong arsenic mirror. Assay by means of precipitation with hydro-sulphuric acid, &c., yielded 0·16 per cent. of arsenic acid. The same sample contained also 0·014 per cent. of vanadic acid. The latter may be recognised by passing through a solution of the caustic soda a current of hydro-sulphuric acid, when the liquid will finally assume an intense reddish-violet. This is filtered and acidulated with dilute sulphuric acid, when a precipitate will be obtained which, after being washed, will produce with borax a yellow bead in the outer blow-pipe flame, and a green bead in the inner. On heating the precipitate in the air, a reddish-yellow mass is obtained which is soluble in ammonia with a yellow colour. The latter solution, slightly acidulated with hydrochloric acid, yields a bluish-black precipitate with infusion of nutgalls.—*Dingler's Pol. Journ.*

MILK ANALYSIS AT MANCHESTER.

The following correspondence will be of interest to our readers:—

To the Editor of "The Manchester City News."

Sir,—In your issue of Saturday last you report a case in which a farmer was fined 40s. on the report of Mr. Estcourt, the city analyst, that it contained "eight per cent. of added water," although evidence was given on behalf of the defendant that no water had been put in. Permit me to give my experience of a recent occurrence:—On the 9th August I was at a farm in Chadderton, when a desire to "test" the analyst of the City of Manchester came upon me. I have long had an opinion of my own about the value of certain analyses. With the consent of the farmer I went into the shippon—it was then milking time—and I saw two of the cows milked. The milk from each cow was poured into a larger milk pail, and about a quart of this liquid was poured into a jug, and a bottle was at once filled from the jug. I put a cork into that bottle, and conveyed it to Mr. Estcourt's office in Manchester, on my next journey thither on the 12th. I asked Mr. Estcourt's assistant what it would cost to analyze it, and I was informed 15s. 9d., which sum I paid. I was next subjected to a cross-examination, which reminded me very forcibly of the process which a young lady would have to undergo if she paid a visit to a gipsy in order to obtain a look into futurity. Let me here say that for obvious reasons I gave a feigned name and address—that of a friend in Lower Broughton. In due course I received the report of the analyst, which stated that the sample contained "added water," and that it was deficient in fat.

My curiosity was excited, and I determined to gratify it. I therefore visited Mr. Estcourt again and this time I was the "pumper." The result of what came out in our conversation, of which I took notes in Mr. Estcourt's presence, was that the sample of milk which I took to him had from 20 to 50 per cent of "added water," according to the standard of quality set up as the ideal standard, but at the lowest standard of pure milk fixed, it contained the former quantity of "added water." "Now as to the fat, Mr. Estcourt; you say it is deficient in fat. Has fat been abstracted?" His reply was "Yes." "What percentage?" "Taking the quality of the milk as a low one, from four to ten per cent of fat has been abstracted."

I am prepared to prove that the milk in question was pure milk, just as it came from the cow, and that it contained no added water whatever, nor had any fat been abstracted from it when handed in for analysis, and I challenge Mr. Estcourt to have the matter tried fairly out. Mr. Headlam may well exclaim, in connection with the case he tried, that "it was a most extraordinary thing that there was water in the milk, when nobody appeared to have put it there." Mr. Estcourt's explanation will probably be that some of the cows are more cunning than honest to the farmer who supplies them with food and shelter.

I have said nothing here but what has been proved and admitted on oath before magistrates, and remain, without further comment, yours truly, S. WALL.

Union Street, Oldham.

In reply to this communication, Mr. Estcourt sent a letter, from which we take the following:—

About four years ago a farmer, named Cheetham, of Chadderton, was fined in the Oldham Police Court £20 and costs for milk adulteration. On July 13th last, among the samples received from the Oldham authorities for analysis, two were returned by me as having been skimmed—one to the extent of 36 per cent., the other 60 per cent. On attending court at Oldham, on 4th August, in these cases, I found the vendor of the two samples was the same farmer, Cheetham. The cases were heard, and the defence offered was that the summonses were short-served. The cases were dismissed and the magistrates granted fresh summonses to be heard 20th August. Between the two hearings the farmer, who might easily have obtained an independent analyses of the two *duplicate* samples which were delivered to him on 13th July, engaged Mr. Wall to assist him in preparing a sample, ostensibly to test the modern method of milk analysis, in reality to mystify the authorities. As will be seen, the defendant afterwards admits in his evidence the accuracy of the method.

The S. Wall sample however—taking his own statement in evidence—was *fore* milk, and was therefore not milk such as ordinary purchasers expect to get. It was milked from *two* cows only (selected by the farmer), not from the herd, as were my samples. It was milked on 9th August, yet not delivered at my laboratory until the 12th. When received here it was not sour, or curdled, as samples of milk are found to be after three days' keeping by ordinary persons. All these facts do not lend much aid in proof of its identity with the milk said to have been obtained from the cows at Chadderton.

As stated in my report to Mr. Wall, the sample had (taking good milk as standard) been watered and skimmed. As to the verbal information Mr. Wall received, and which he wrote down, with his book under the edge of my writing table, he has either ignorantly or designedly confused and inverted the sense, for I distinctly told him that there was, taking good milk as a standard, three per cent. of water added and forty to fifty per cent. fat gone, which fact in his evidence he practically admits by stating that it was fore milk.

In the reports of the case, the farmer and his wife both state that in one case they sold only the fore or first part milked, and kept the last portion of the milking to be used by them for making butter. In the second case they declare *they skimmed the milk*. In my certificate, when I find a deficiency of cream, I can only state the fact that *the cream has been abstracted*, and on this point the defendant corroborates my certificate of analysis.

In conclusion, Mr. Estcourt says, "alluding to the last paragraph in Mr. Wall's letter, the report of the case proves him to be, to say the least, unreliable, for no part of what he says was *proved* and *admitted* on oath before magistrates."

The following is an abbreviated report of the case referred to, the italics being ours:—

At the Oldham Borough Police Court, on 20th August, before Mr. Knott and other magistrates, James Cheetham, of Chadderton, was summoned for a breach of the sale of Food Act. Mr. J. Ponsonby, solicitor, defended him. J. E. Drew, inspector, stated that on the 13th of July he purchased a quart of milk from the defendant, a sample of which he took to Mr. Estcourt, the analyst. In reply to Mr. Ponsonby, witness said he did not ask for "fore" milk; he did not know the term. He did not notice that the milk was of a bluish tint. Mr. Estcourt, then stated that 36 per cent. of the fat had been abstracted fron the sample. Mr. Ponsonby asked Mr. Estcourt how long it would take for cream to rise to the top. Mr. Estcourt: It depends upon circumstances. Mr. Ponsonby: Would there be a change in half an hour? Mr. Estcourt: I have no doubt there would. Mr. Ponsonby: How is fat abstracted? Witness: Ordinarily by skimming. Mr. Ponsonby: You are of opinion that the milk has been skimmed? Witness: Yes. Is 36 per cent. an unusual quantity of fat to abstract? I think 36 per cent. leaves an unusually small quantity to sell for new milk. Mrs. Cheetham, wife of the defendant, was then called, and she stated that on the morning of the 13th ult. the milk, after standing at the door in some cold water to cool, was put into a can. The milk sent out was morning's *fore* milk. The "afterings" was kept to make butter and cream. The defendant corroborated his wife's statement, and added that when Drew came to him he said "Sell me a quart of *fore* milk." There was more fat in the after milk than in the fore milk. Stephen Wall was then called. He stated that he procured a sample of milk from the defendant's cows on the 9th. He saw the two cows milked, and the milked poured into one can. It was *fore milk*. Some of it was poured into a bottle, which he delivered to Mr. Estcourt's assistant on the 9th. The Bench ruled that this evidence had no bearing on the case, as it related to milk procured at another time. Dr. Sutton then stated that there was another case against defendant. Drew stated that he purchased a second sample of milk from the defendant, which he called night's milk. Witness paid 4d. for it. Mr Ponsonby: What do you mean by night's milk? Witness: I don't know, sir; it is a term of his own. Was that can marked pure milk? I won't swear that at all. Mr. Estcourt stated that on analysis he found 60 per cent. of the fat had been abstracted from the sample submited to him. Matilda Cheetham, defendant's wife, stated that on the night of the 12th the *milk was skimmed*. The milk was sold as skimmed at 3d. per quart. Defendant stated that he told Drew that the milk was "night's milk" skimmed. He paid 3d. for the milk, which was the usual charge. Dr. Sutton here said this case was a very important one. Sixty per cent. of fat abstracted meant so much starving of children and infants. It was no wonder they found weak children when they were fed on this "material." After hearing Mr. Ponsonby's defence, the Bench retired, and, on returning into court, Mr. Knott said that in the first case the magistrates were unanimously of opinion there must be a conviction. The defendant would be fined £10 and costs. In the second case they were also satisfied there must be a conviction, and a penalty of £10 and costs would also be inflicted in this instance. Mr. Ponsonby: I give notice of appeal. Mr. Knott: There will be time enough for that.

ANALYSTS' REPORTS.

At a late weekly meeting of the Vestry of St. Marylebone, Dr. A. Wynter Blyth, in his quarterly report under the Sale of Food and Drugs Act, states that during the three months ending September 30, 1881, he had tested 27 samples of food—viz., 8 of mustard, 2 of arrowroot, 1 of black and 1 of white pepper, 4 of coffee, and 11 of milk. Two of the latter were moderately diluted with water, while the whole of the other 25 were of fair purity.

Dr. Redwood, in his report for the last financial year of the Holborn District Board of Works, states that he had received from Mr. G. C. Peacock, the inspector, 73 samples, consisting of bread, milk, butter, beer, ale, whisky, gin, brandy, and rum. With the exception of 18 samples of milk, the whole of the other 55 samples were unadulterated.

LAW REPORTS.

Heavy Fines for Adulterating Bread with Alum:—

At Ramsgate, William Popple, of 78, High Street, pleaded guilty to selling, on the 11th August, to the prejudice of a customer, bread not of the nature, quality, or substance demanded.—Maria Cashford, the wife of a police-constable, said she was employed by Mr. May on the 11th August to go to defendant's shop where she purchased a 2-lb. loaf and paid 3½d. for it. She handed the loaf to Mr. May who was at the door, and Miss Popple, who served witness, called her father, and Mr. May told him he intended to have the bread analysed.—Mr. Edward S. May, Inspector of Nuisances, said he received the loaf mentioned from the last witness, which he requested her to purchase. He saw defendant and told him he intended to have the bread analysed by the Public Analyst. Witness divided the loaf into three parts, one of which he gave to the defendant, another he delivered to Mr. Sidney Harvey at Canterbury on the same day, and the other he produced. On the 17th August witness received a certificate stating that the sample was adulterated with alum to the extent of more than 27 grains to a 4-lb. loaf, and he (Mr. Harvey) added: "I am of opinion that the addition of alum to bread renders the same indigestible and injurious to health."—Defendant, in reply to the Bench, said his bread turned out rather queer for two or three days, and he fell back upon "that stuff;" it was unusual for him to use it, and unfortunately Mr. May had one of the loaves.—The Chairman said defendant had made no tangible excuse, and the Bench fined him £5 and 11s. costs.

John Sutton, of 18, Queen Street, pleaded not guilty to a similar charge.—Mrs. Cashford proved purchasing a 2-lb. loaf for 3½d. of Mrs. Sutton. Mr. Sutton was called into the shop and the Inspector told him he should have the bread analysed.—Mr. May said he received the loaf in question from the last witness (whom he employed), in the shop, and told defendant he should have it analysed by the Public Analyst, whose certificate, dated the 18th August, he now produced. It stated that the sample received from witness on the 11th August, and marked 31, was adulterated with alum to the extent of more than 13 grains in a 4-lb. loaf.—Defendant said if there was anything in his bread, it was in the flour when he purchased it.—The Chairman said that, although there was less alum, the Bench found no difference in the cases, and defendant was fined £5 and 11s. costs.

In reply to the Bench, Mr. May said he submitted ten samples to the Public Analyst, but these were the only two cases he had brought against bakers for adulterating bread with alum. The analyst, however, remarked that in all the samples there was from three to six per cent. of moisture more than good bread ought to contain, and pointed out that this excess of water in the bread was a "serious fraud" which did not fall within the scope of the Act of Parliament.

A Tremendous Fine:—

At West Hartlepool, recently, two heavy penalties were inflicted by the county magistrates for milk adulteration. In the first case, a farmer, named Thomas Robinson, charged for the third time with the offence, and the analysis showing that 33 per cent. of water adulterated the milk, was fined £50 and costs, or three months' imprisonment. In the second, Frederick Levers, a milk-seller, whose milk on analysis showed 22 per cent. of water, was fined £10 and costs, or six weeks' imprisonment. A third, where a slighter adulteration was proved, was adjourned for the appearance of the original seller.

Decision as to the 28 Days' Limit Required by the Act:—

At Sunderland, Hamilton T. Hardman, provision merchant, and the occupier of a stall in the Market, was lately charged by William McKay, inspector of nuisances to the Corporation, with selling butter adulterated to the extent of 76 per cent. with foreign fats, on the 30th June. Mr. F. M. Bowey, Deputy Town Clerk, appeared in support of the charge, and Mr. Marshall defended. The inspector proved buying the article as butter, and a certificate from Dr. Yeld, the borough analyst, stated that it was adulterated to the extent named. Mr. Marshall said he had an objection to the summons to raise. The alleged offence was committed at noon on the 30th June, and the summons was not served until the evening of the 28th July. He contended that as more than 28 days, allowed by law, had elapsed, the summons must break down. Mr. Bowey, in reply, said if the summons had not been served within 28 days, as regarded the hours, it had been legally served as regarded the days themselves. The Bench overruled the objection. Mr. Marshall said his defence to the charge was that the defendant's son, a little boy, who had perhaps somewhat carelessly been left in charge of the stall, had inadvertently sold butterine for butter, and even though an offence might thus have been committed, he asked the Bench to deal leniently with the defendant. The Bench considered the case proved, and fined the defendant 5s. and costs, a distress warrant to be issued in default.

A Milk-Vendor Sentenced to Imprisonment:—

At Ramsgate, Edward Coleman was summoned for selling to the prejudice of Edward Stephen May, milk not of the nature, substance, and quality demanded.—Defendant pleaded not guilty.—Mr. C. J. Mercer appeared for defendant.—Mr. May said that on Tuesday, the 9th August, he met defendant with his cart at the top of Meeting Street, and asked him for a pint of milk. Defendant took the milk from one can, and witness paid him 2½d. for it, telling him he intended to have it analysed by the public analyst. He divided it into three parts, one of which he delivered to Mr. Harvey the same day. He produced a certificate, dated 11th August, from that gentleman, which stated that the sample was adulterated with 15 per cent. of added water.—Cross-examined: Did not think defendant told him he bought the milk of anyone. Did not say he never put water in it, or that he had had it from three different people, and he thought it was quite pure.—Mr. Mercer said that practically there was no defence to this case, as his client had not thought fit to get a certificate from whom he bought it. He suggested that the first customers got the best of the milk, and submitted that 15 per cent. of added water was not a great deal.—The Chairman notified their intention to convict in this case, but said they would hear the other summons against the defendant before deciding upon the penalty.

Defendant (Coleman) was then further charged with having in his cart, on the same date, certain "milk," apparently for sale as food for man, which had been condemned by two of Her Majesty's Justices as being unfit for the food of man.—Defendant pleaded not guilty.—Mr. E. S. May said that on Tuesday, the 9th August, he was coming down High Street and on looking up George Street he saw the defendant with a horse and cart. Upon observing witness, defendant whipped up the horse and drove up into Meeting Street. Witness then went back up High Street, and, on looking up Meeting Street, saw defendant get out of his cart with the intention of serving two of his customers, but as soon as he saw him (Mr. May) he turned his pony round and drove off to the end of the street again and round the corner without serving his customers. Defendant was just about to drive off when witness overtook him. He then purchased, as stated in the previous case, one pint of milk, which defendant took from one can in the cart. After purchasing it, witness asked defendant why he served him from that particular can, and he replied that it was "all the same sort" in the other two cans. Witness asked him to open the lid of the centre can, which he did, and it was empty. He then asked defendant to open the lid of the third can, which he declined to do, again stating it was "all the same," and there was no need for him to open it. Witness then removed the lid, and found the can contained about a gallon of liquid which looked like milk; he seized it, and took it out of the cart, as being unfit for the food of man. After setting it down on the pavement he gave defendant an opportunity of explaining why he was carrying it, but he gave no explanation whatever. Witness brought the contents of the can before two of Her Majesty's Justices of the Peace, on the 11th ult., when defendant was present, and an order was made condemning the "milk" as unfit for the food of man. Witness produced a sample of the "milk" taken from the can he seized (a mixture resembling soap-water, with lumps of apparently soap floating in it). Witness sent a similar sample to that produced, taken from the can, to the Public Analyst (Mr. S. Harvey) from whom he received a certificate stating that it consisted of water with less than one per cent. of milk. There was no other matter detected in it, and witness asked the analyst to look especially for blood. The can seized was very filthy inside, and there was a bad smell about the contents. The witness said that he would like to add that he had had several complaints from the defendant's customers.—Cross-examined: He had not discovered that this water was used to bathe the pony's leg; he had discovered just the contrary. Defendant gave him no explanation as to what the water was for until six hours afterwards, when he stopped him coming from the station at ten o'clock at night, and said he wished to tell the "truth" about it. Defendant said his pony was frightened by a bicycle, and slipped down on the kerb in Effingham Street, cutting its knee, and he got the water from a person's house in the neighbourhood to bathe it with, using the rag that was on the top of the can. Defendant told witness he used the rag as he had no other. He did not explain that the colour of the water was caused by using the milky rag and soap. Defendant at the same time told witness that he used the can seized for collecting fowls' victuals in, and that it had nothing to do with the milk. Witness had every reason to believe that the water was carried in the cart to mix up with the milk.—Witness added to his evidence in chief that he had examined the pony's knees with Police-Constable Axon, and there was not the slightest symptoms of any recent injury.

After some corroborative evidence had been given, Mr. Mercer, for the defence, said he was instructed that this was a malicious prosecution. The statement made to him by his client (who could not be put in the witness box) was that on the day in question his pony was frightened by a bicycle, and that it fell down on to the kerb in Effingham-street and cut a piece out of its knee about the size of a five-shilling piece. He went to his sister's and procured some water which had soap in it to bathe the pony's knee. Unfortunately, Mr. May caught him and tried to suggest that it was in his cart for the purpose of adulterating the milk; he submitted that it was not likely a man would run such a risk. He (Mr. Mercer) had sent for the defendant's sister who supplied the water, but she had not arrived, and as this was a most serious case for his client he asked for an adjournment to enable her to get there.—The Bench expressed the opinion that defendant had ample time to get his sister there.—Mr. Mercer said the sister had been sent for, and he hoped their Worships would give him the opportunity of calling her, as defendant, he admitted, ought to be severely punished if he were found guilty. In conclusion, he submitted to their Worships that the summons must fail, inasmuch as the defendant had been summoned there for selling "certain milk," whereas the analyst said there was no milk, only one per cent., and that was to be accounted for by defendant having used the milk rag in the water to bathe the pony's knee.—The Magistrates retired, and after a short absence returned to the Court, when Mr. Mercer said he thought his witness was present, if they would allow him to call her.—The Chairman said that if it was only as to her giving defendant the water it would not alter his decision. He then said that in the first case—which was that of selling adulterated milk—defendant would be fined 40s. and 10s. costs, or one month. In the other instance—where the "milk" was unfit for the food of man—the Bench considered it a very gross case, and they would send him to prison for one month's hard labour without the option of a fine.—Defendant paid the 50s., and was removed in custody.

Sarah Austen, of 12, La Belle Alliance Square, was summoned for a similar offence, and her son appeared.—Mr. May having given evidence, put in the analyst's certificate, which stated that the milk was adulterated with 11 per cent. of added water.—Defendant's son said they could not be answerable for the milk; it was the dairy farmers who adulterated it and derived the benefit.—Fined 30s. and 11s. costs. The money was paid.

HORDER *v.* MEDDINGS.—Coffee adulterated with 75 per cent. of chicory. Coffee asked for by purchaser after sale, but before delivery. Vendor labelled it a mixture, &c., on proof of which fact the magistrate refused to convict. Case remitted to magistrate because he had not found whether the statement of the mixture was for the purpose of concealing fraudulent increase in the bulk of the article. Semble that it was—otherwise vendor's defence good.—44 J.P. 234.

NEW YORK STATE ADULTERATION ACT.—With reference to the list of groups of drugs and food, and the chemists to whom they had been assigned for examination, published in our September number, we are informed that the work now being done in the State of New York on the examination of food is only preliminary, and that later each analyst will examine whatever samples are submitted to him by the proper authorities, without regard to any particular group previously examined.

BY the Act recently passed by the New York State Legislature, the State Board of Health were authorized to investigate the subject of adulterations in food, and they have already begun work. Inspectors have been appointed to collect and analyze samples of butter, beer, baking powder, bakers' chemicals, cocoa, cordials, canned food, confections, cereals, cheese, meat extracts, fish and fish extracts, fruit essences, ether, gelatine, honey, ice-cream, milk, molasses, lard-oil, olive-oil, quinine, sugar, syrups, soda-water, spices, spirits, tea, wine, and all pharmaceutical preparations. It may be remembered that partial investigation of this kind was made some time ago by the City Board of Health. They found that in the case of sugar of one hundred and nine samples, forty-five only were thoroughly pure and good; fifty-one, however, contained only accidental dust, while eight were marked dirty, and five were dirty. Still, in no case was there any intentional adulteration, and all the samples were free from glucose, which substance is now largely introduced. It is not likely that much which is really injurious will be found, though adulterations may be numerous enough. Still, in the matter of teas, coffee, spices, condiments, confectionery, and diseased or putrid meats, there is no doubt room for plenty of investigations.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—The enclosed letter is, I think, so amusing, that it might be inserted in The Analyst, along with the reply. I need scarcely add that I was *not* asked to proceed with the analysis; but it is only fair to the merchant to say that I tasted his whisky and found it very good.

Yours faithfully,

Oct. 24th, 1881. W. WALLACE.

(Enclosure.)

———, *Oct 11th*, 1881.

Dear Sir,—Per this post I have written Mr. ———, ——— Street, Glasgow, to send you from his Customs' Bonded Warehouse a labelled bottle of my blended whisky lying in bond there. Will you kindly let me know your fee for analysing the same and granting a certificate somewhat like the following. I wish to push the sale of a really good whisky in this Island (——) in place of the new and inferior whisky generally sold. I believe my blend possesses all I state on other side.

Yours truly,

———

Dr. Wallace, Analytical Chemist,
138, *Bath Street, Glasgow.*

"I have obtained from the Custom's Bonded Warehouse in Glasgow a bottle of your 'Old Highland Whisky,' and after a careful examination and analysis of it, I find it to be an absolutely pure, old, well matured, mellow whisky. It is an excellent and wholesome medicinal and dietetic stimulant, without a trace of fusel oil."

City Analysts' Laboratory,
138, *Bath Street, Glasgow Oct. 14th*, 1881.

Sir,—I shall be glad to make an analysis of the sample of whisky, and to give an honest opinion regarding it, my fee for which is ——.

My certificate is not likely to be quite so flattering as the form you send in your letter. If the spirit were absolutely pure it would not be whisky at all; and as I am not a medical man, but only a chemist, I cannot give any opinion as to its medicinal and dietetic qualities.

Yours truly,

W. WALLACE.

OLEFINES IN SHALE AND PETROLEUM PRODUCTS.

To the Editor of "The Analyst."

Sir,—I was away from home when the proof of my paper "On the Relative Proportions of Olefines in Shale and Petroleum Products" was sent to me for correction, and hence it has been printed with some errors, which I shall be obliged if you will allow me the opportunity of correcting.

1. On page 178, line 10, after "brominated" insert the word "oil."
2. On page 179, lines 2 and 3, for "the sulphate" read "thiosulphate."

I must also protest against the spelling adopted by the printer, who evidently has strong opinions on the subject of chemical nomenclature. I should not like the readers of The Analyst to think I was responsible for such a term as "paraffine."

I may take this opportunity of protesting against the loose terminology adopted by chemists, from whom we might look for better things. It is bad enough to have the terminative *ine* applied to glucosides as well as organic bases, but it becomes intolerable when used for hydrocarbons. We might do much to prevent such abuses of our scientific language by greater care ourselves. There is no reason why we should not write "benzo*lene*," "gaso*lene*," and "vase*lene*" for the petroleum products; and I should much like to see the ethylene series of hydrocarbons called ole*fins* or ole*fenes*, instead of ole*fines*. Ben*zol*, too, is an objectionable name, and when used should be limited to the complex *mixture* of hydrocarbons from coal tar, of which ben*zene* is the leading constituent.

Yours truly,

ALFRED H. ALLEN.

What is Adulteration of Food?—An American contemporary says: A recent decision in a case of alleged adulteration of buttermilk is of interest in connection with our present new adulteration laws. The judge in this case quashed the indictment (which was for watering the milk), and defined adulteration as the addition of some unwholesome ingredient for the purpose of cheating, by making the purchaser pay more than it was worth.

The *Correspondence Scientifique* gives some details of the new method of extracting magnesia from sea water. The magnesia can be precipitated by lime, like any more concentrated solution. After precipitation and allowing to stand during a day, one cubic metre of sea water gives a precipitation of gelatinous magnesia equal to a volume of 80 litres. A dilute quantity of phosphoric acid is then used, and the final precipitate is considered to be a good fertilizer. The method has not yet been tested on a large scale.

Mr. J. Falconer King, City Analyst, Edinburgh, has been appointed Public Analyst for the County of Roxburgh.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1880	Name of Patentee.	Title of Patent.	Price.
5282	G. De Laire	Preparation of Vanalline	4d.
1881			
781	H. J. Haddan	Extracting Oxygen from Atmospheric Air	6d.
868	H Guliani	Preparation of Vegetable Substances for Food	4d.
894	J. J. Sachs	Electric Lamps	6d.
896	W. H. Atkinson	Refining Camphor	6d.
963	H. J. Haddan	Dry Copying Ink	2d.
968	W. Weldon	Manufacture of Chlorine	6d.
980	Do.	Manufacture of Soda	2d.
983	A. Parkes	Treatment of Cellulose, &c.	6d.
1002	T & G. Priestman & J. Longshaw	Treatment of Tan Liquors for Manufacture of Ink	2d.
1027	J. A. Beily	Electric Lamps	4d.
1040	A. A. Common & H. F. Joel	do.	6d.
1048	J. Imray	Manufacture of Maltose	2d.
1063	J. H. Johnson	Treatment of Ores, &c.	2d.
1161	E Carey & H. Gaskell	Purification of Alkaline Solutions	4d.
1202	M. P. W. Boulton	Caloric Engines Heated by Internal Combustion of Gas	4d.
1212	J. A. Dixon	Production of Colouring Matters from Para-Nitrobenzaldehyde, &c.	4d.
1225	Do.	Manufacture of Colouring Matters and Preparation of a new Mono-Sulpho Acid of Beta Napthol	4d.
2179	Do.	Production of Metaoxybenzaldehyde	4d.
2543	A. J. Boult	Manufacture of Soap	4d.
2907	C. Semper	Manufacture of Sulphate of Alumina	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist, The Brewers' Guardian, The British Medical Journal, The Medical Press, The Pharmaceutical Journal, The Sanitary Record, The Miller, Journal of Applied Science, The Provisioner, The Practitioner, New Remedies, Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record, New York Public Health, The Scientific American; Society of Arts Journal, Sanitary Engineer of New York, The Chemists' Journal, Oil and Drug News; The Textile Record of America, Sugar Cane, Country Brewers Gazette, The Medical Record; Oil and Drug Journal, The Canada Lancet, The National Live Stock Journal, Relative Advantages of Wind, Water and Steam, by S. B. Goslin.

THE ANALYST.

DECEMBER, 1881.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on the 16th inst. at Burlington House. The chair was taken by Dr. Muter, F.C.S., F.I.C., Vice-President.

The minutes of the previous meeting were read and confirmed.

The ballot papers having been opened, it was reported that Mr. W. J. R. Simpson, M.D., Aberdeen, had been duly elected a member.

The following were proposed for election:—As a Member: Mr. C. N. Hake, F.I.C., Analytical Chemist, London. As Associates: Mr. J. P. Laws, assistant to Mr. Bernard Dyer; and Mr. F. T. Strutt, assistant to Dr. Hodgson Ellis, of Toronto.

Messrs. Dyer and Hobbs were appointed auditors to examine the accounts for the current year.

The following papers were read and discussed:—

"On the Estimation of Nitric Acid," by J. West-Knights, F.C.S., F.I.C.

"Note on Sugar Titration," "Somerset House Analyses," by O. Hehner, F.C.S., F.I.C.

"On the Effectiveness of Centrifugal Machines for the Separation of Cream from Milk," by A. Smetham.

A Special General Meeting will be held at Burlington House on Wednesday, the 14th December next, at 8 o'clock, and among the Papers to be read will be the following, announced for the last meeting, but unavoidably postponed—"Some Observations on the Permanganate Test," by A. Dupré, Ph.D., F.R.S., &c., and also "A New Method of Testing for Alum," by A. Wynter Blyth, M.R.C.S., &c.

ON THE ESTIMATION OF NITRIC ACID.

By J. West-Knights, F.I.C., F.C.S.

Read before the Society of Public Analysts, on 16th November, 1881.

It is generally supposed that nitric acid in acid solution is only partially converted into ammonia by nascent hydrogen (Fresenius' Quantitative Analysis, 6th edition, p. 348); but I have found that it is quite possible to obtain the whole of the nitric acid present, in the form of ammonia, when proper precautions are taken. When a nitrate is dissolved in water in the presence of sulphuric acid and zinc, the N_2O_5 is first converted into N_2O_3, and after prolonged action the latter is completely converted into NH_3 by the nascent hydrogen.

As the reduction, when once started, requires but little attention until completed, the time occupied is of little importance, as the analysis can be left standing all night, and will, in most cases, be complete in the morning. After the reduction the NH_3 can be distilled into standard acid after making the solution strongly alkaline with caustic soda, and estimated in the usual way by titrating the residual acid with half normal alkali.

Before commencing the distillation it is necessary to test the completeness of the reduction; this is best done by adding about 1 c.c. of decinormal permanganate solution. If the permanganate is quickly destroyed, nitrous acid is still present, and the reducing action must be continued; but if, on the other hand, 1 c.c. produces a permanent tint, the action may be considered complete.

The process will be best described by giving examples: Six separate quantities of 0·5 grm. of pure nitrate of potash were taken and each dissolved in about 80 c.c. of water, 10 c.c. of H_2SO_4 (one vol. acid to three of water) was added and a stick of zinc, six inches long, was placed in each flask, and the whole allowed to remain all night; in the morning 5 c.c. more acid was added to again stimulate the evolution of hydrogen. In half an hour the rods of zinc were lifted out, rinsed with distilled water, the samples were tested with permanganate, then rendered alkaline by the addition of three or four short sticks of caustic soda, and distilled into 10 c.c. of normal sulphuric acid contained in a U tube, having a bulb blown on each arm, and being immersed in cold water. After the distillation the contents of the U tube were washed into a beaker and titrated with half normal NaHO with the following results:—

No.	$K_2 Mn_2 O_8$ destroyed.	Standard Acid neutralized =	KNO_3
1	2·0 c.c.	4·9 c.c. =	·505
2	1·0 c.c.	4 9 c.c. =	·499
3	0 0 c c.	5·0 c c. =	·505
4	0·0 c.c.	4·0 c.c. =	·494
5	·5 c.c.	4·9 c.c.	·496
6	2·0 c.c.	4·8 c.c. =	·494

The calculations are made, in the case of nitrate of potash, by multiplying the number of c.c. of permanganate and acid respectively by ·00505 and ·101, and adding the results together; but I prefer to have the whole of the nitrous acid converted into ammonia, or at least not to have more than is equal to 1 c.c. of permanganate left, as experiments made in which one-third or one-half of the whole of the nitrous acid was purposely left unconverted, and allowed for by titration with permanganate, were very unsatisfactory.

I think this method will be found more simple and manageable than Harcourt's, and the results fully as accurate; but, of course, reducible and oxidizable substances, as iron, &c., must be absent.

NOTE ON SUGAR TITRATION.

By Otto Hehner.

Read before the Society of Public Analysts, on 16th November, 1881.

The reaction between sugar and Fehling solution has, during the last few years, been the subject of a number of critical investigations, and it has been proved that it cannot be expressed by any equivalent relation, but that the reduction of Cu_2O is a function of concentration, alkalinity, time of heating, and other circumstances—and that, in fact, the method only gives correct results when similar conditions are as nearly as possible adhered to.

These investigations only applied to Fehling solution as ordinarily made, with copper sulphate, alkali, and tartrate. Having some years ago (*Chem. News*, xxxix. 197) tested,and obtained *under certain conditions*, very satisfactory results, with the ammoniacal Fehling solution, proposed by Dr. Pavy (*Chem. News*, xxxix. 77), and having proved that the amount of alkali present in it greatly influences the ratio of reduction, I was led to examine the influence of other substances upon the same.

The presence of ammonia in the copper solution renders that of tartrate unnecessary, the tartrate merely being used to keep the alkali from precipitating cupric hydrate. As glucose readily reduces copper sulphate in plain ammoniacal solution—although much less rapidly than in the presence of potash—it seemed most advantageous to start with such simple ammoniacal solution only, and thus to avoid possible complications due to the tartrate or alkali. Using the copper solution of the ordinary strength, 34·639 grammes of the sulphate per litre, and employing a glucose solution which had been obtained by inverting cane sugar by 10 per cent. HCl. and exactly neutralizing with soda, I assumed for the purpose of comparison only, that the ration of reduction of Cu_2O was the same under the circumstances of the following experiments as with ordinary Fehling solution. This, of course, is not the case, but the results, percentically expressed, give the measure of any fluctuation.

Sugar determined—

With $CuSO_4 + NH_3$	obtained	90·70	per cent. glucose.
„ „	„	90·00	„ „
+ 1·5 grm. iod. pot. tartrate	„	114·9	„ „
+ 6 grms. tartrate	„	146 6	„ „

A new sugar solution exactly neutralized with NaHO gave—

With $CuSO_4 + NH_3$	100·3	
„ „	99 8	per cent. of glucose taken.
+ 1 grm. tartrate	123.9	
+ 2 grms. „	126 1	
+ 5 „ „	135 8	
+ 10 „ „	142·1	
$CuSO_4 + NH_3$ + 2 grms. sod. acetate	98·9	pei cent. glucose.
+ 5 „ „ „	99·3	„ „
+ 10 „ „ „	99 0	„ „
$CuSO_4 + NH_3$ + sod. carbonate, dry, 1 grm.	105·7	
2 „	108·1	
5 „	112·6	
10 „	113·4	
$CuSO_4 + NH_3$ + 1 grm. NH_4Cl.	79 7	
+ 5 „ „	79 9	
+ 10 „ „	81 8	

The figures speak for themselves—they show that the ratio of reduction is influenced to a very considerable extent by the substances experimented upon, the percentages being raised or depressed according to the nature of the addition, and that, therefore, sugar titration by ammoniacal copper solution can only give correct result by a concurrence of favourable circumstances, and only when certain conditions are scrupulously adhered to. Of course, in actual work, neither the quantity of tartrate nor of potassium carbonate would fluctuate so widely as the extremes in the test experiments quoted; but a fluctuation must necessarily follow any variation in the strength, dilution, or composition of the test fluid. While I, therefore, fully concede that correct results *may* be obtained by means of ammoniacal copper solution, yet it is evident that the method is devoid of the essential conditions of a trustworthy analytical method.

An ammoniacal solution of sulphate of copper cannot, without further addition, be utilised for determining sugar, on account of the slowness of the reaction, and because the end-point of the titration is not sufficiently distinct.

NOTE ON THE EFFICIENCY OF CENTRIFUGAL MACHINES FOR THE SEPARATION OF CREAM FROM MILK.

By Alfred Smetham, F.C.S.

Read before the Society of Public Analysts, on 16th November, 1881.

The application of centrifugal force to the separation of cream from milk is not new to the scientific world, and analyses of the skim milk so obtained have already been published; but as I have lately had the opportunity of comparing two different forms of apparatus under precisely the same conditions, and have analysed both the cream and skim milk produced, I have thought that the results might prove interesting.

The two forms on which I experimented were the "Danish" and the "Laval." The former is a recent invention and was only introduced into England in July last, when it was exhibited at the Royal Agricultural Society's Show at Derby, while the latter is comparatively well known, and has been in use for several years.

The "Danish" has an advantage in the fact that the tube by which the cream is conducted after separation is adjustable (whereas in the "Laval" it is fixed), and cream can therefore be obtained of any density—no matter at what rate the separation is taking place. The difference is clearly marked in the following analyses, which were obtained from two portions of the same delivery of milk:—

	"Laval" Running 29½ gals. per hour.	"Danish" Running 48½ gals. per hour.
Water	61·46	52·32
Fatty Matters	33·44	42·68
Casein, Albumen and Milk Sugar	4·56	4·42
Mineral Matters	·54	·58
	100·00	100·00

The skim milk obtained at the same time had the following composition:—

	"Laval" Running at 29½ gals. per hour.	"Danish" Running at	
		48½ gals. per hour.	52½ gals. per hour.
Water	91·72	91·82	91·36
Fatty Matters	·29	·11	·44
Casein and Milk Sugar	7·22	7·32	7·41
Mineral Matters	·77	·75	·79
	100·00	100·00	100·10

The power was unfortunately deficient, and it was found impossible to run the machines at their full speed; but, notwithstanding this drawback, it will be observed that the results in both instances were highly satisfactory.

There can be no doubt that by the aid of these machines the cream may be practically all removed—far more completely, in fact, than by the ordinary method of setting; and as, moreover, the cream and skim milk are perfectly fresh, it will be apparent that in large dairies (especially those which supply towns) their use will become almost a necessity.

The actual saving in butter-making, by reason of the more complete removal of the cream, will be very important —to say nothing of the indirect saving in the cost of pans and dairy fittings.

It appears to me highly probable that in the course of a few years the use of these machines will become pretty general, and I fear this will by no means lighten the duties of Public Analysts. By their aid it will be in the power of dairymen to remove the cream at will, without at the same time adding to the staleness of the milk; and it will, therefore, be possible to reduce the cream to any standard fixed by the Society.

In conclusion, I must remark on the low quality of the milk, but this, of course, has practically no bearing upon the efficiency of the machines.

ON ALMEIRA GRAPE JUICE.

By J. Carter Bell.

I had not time to incorporate the following analysis in my paper upon "Grape Juice," which was published in last month's Analyst. The juice is from grapes grown this year, 1881:—

Specific Gravity of Juice	1069
Total Acid in 100 c c. calculated as Tartaric Acid	·60
Total Ash from 100 c.c.	·312
Per cent. of Ash soluble in water	83·983
,, ,, Insoluble in water	16·020

Chief Constituents in Ash from Juice.

	Grains in gallon.	Per cent.
Potash	113·047	51·730
Soda	4·450	2·036
Sulphuric Acid	22·018	18·386
Chlorine	·692	·317
Phosphoric Acid, combined with Alkalies	10·888	4·982
Lime	3·825	1·750
Magnesia	8·355	3 823
Phosphate of Iron	·224	·102
Phosphate of Alumina	·336	·153
Phosphate of Lime	17·472	7·995
Silica	·280	·128

REPORT ON CONDENSED MILK.

By Dr. Aug. Voelcker.

(From the *Journal of the British Dairy Farmers' Association*).

The majority of the samples sent in for competition was condensed milk, obtained by evaporating milk partially skimmed, at a low temperature, and with the addition of white refined sugar. A few exhibits were unsweetened milk, or milk evaporated to a certain consistence without the addition of sugar.

Unsweetened Condensed Milk.

The following is the composition of three samples of such unsweetened condensed milk —

	No. 1.	No. 2.	No. 3.
Water	56·96	56·92	51·72
Pure butter fat..	16·02	17·09	14·33
*Casein (curd)	8·50	7·62	11·69
Milk-sugar	16 32	16·22	19·51
Mineral matter (ash)	2 20	2·15	2·75
	100·00	100·00	100·00
*Containing nitrogen.. ..	1·36	1·22	1·87

Two of the samples, it will be seen, contained 57 per cent. of water each, in round numbers. The proportions of water left in these samples appear to be far too large to prevent the condensed milk turning sour on keeping.

On opening one of the tins in which the milk was sent in for competition, the condensed milk was found in an active state of fermentation; and the two other samples turned acid and entered into fermentation the day after opening the vessels in which they were contained.

In the preparation of these and the sweetened samples of condensed milk, neither boracic acid, borax, or preparations containing boracic acid (glacialine), nor salicylic acid, or other preservative agents had been used.

CONDENSED MILK (SWEETENED).

The following is the composition of condensed and tinned milk, in the preparation of which white sugar has been used:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Water	21·68	23·19	22·15	21·53	23·49
Pure butter fat	9 92	6·47	10·60	6·22	9·53
*Casein (curd)	9·19	9 27	8 82	9·41	7·43
Sugar	56 98	58 66	55·96	57·72	57·34
Mineral matter (ash) ..	2 23	2·11	2 17	2·09	2·21
	100·00	100·00	100 00	100 00	100·00
*Containing nitrogen ..	1·47	1·48	1·41	1·51	1·19

All the samples were well-made condensed milk. Such condensed milk will keep for any reasonable length of time. The proportions of water in the various samples varied from 21½ to 24½ per cent. in round numbers. Milk evaporated to an extent as to leave in the finished tinned milk 25 to 26 per cent. of water, according to my experience, is sufficiently concentrated to keep well if otherwise carefully evaporated with the needful proportion of best white sugar.

Two of the condensed milks, it will be seen, contained respectively 6¼ and 6½ per cent. of pure butter fat; the remaining samples from 9½ to 10½ per cent.

All the samples of sweetened condensed or tinned milk sent for competition were in excellent condition; they were all readily soluble in hot water, and produced, when sufficiently diluted with water, agreeably tasting, sweet, milky liquids. As regards taste and flavour, and miscibility with water, there was little to choose between the different samples sent in for competition; in fact, the condition and quality of most of the samples were so much alike that it was not easy to decide to which kind preference should be given.

The quality of condensed milk, in my judgment, depends more upon delicacy of flavour than upon the proportions of butter fat (cream) which occur in different samples—

that is to say, condensed milk comparatively poor in fat may be, and generally is, preferred by the consumer to condensed milk richer in butter fat.

Not unfrequently condensed milk is represented to be nothing more or less than new milk evaporated, at a low temperature, to a certain degree, with the addition of white sugar. None of the five samples analysed by me, however, were produced from whole new milk, but from more or less skimmed milk.

If milk rich in cream is evaporated to a small bulk, even with the greatest care the resulting condensed milk, when mixed with water, draws up oily globules, tastes somewhat rancid, and not so nice and sweet as condensed milk produced from partially skimmed milk.

Really good condensed milk, as a matter of fact, is always made from skim milk, or from milk unusually poor in cream.

In the form of the well-known thick honey-like preparations, condensed sweetened milk is a useful article of food on board ship, or under all circumstances when fresh milk cannot be procured. It certainly is preferable to milk powders, obtained by evaporating skim milk completely to dryness, and with the addition of some sugar, reducing the residue to powder.

However, apart from the greater price of condensed milk, it is not a perfect substitute for new milk, either chemically or physically. At the best, most kinds of good condensed milk are milk-syrups, consisting of concentrated skim milk and white sugar.

MICHIGAN ADULTERATION LAW.

[An Act to prevent and punish the adulteration of articles of food, drink and medicine, and the sale thereof when adulterated.]

Sec. 1. *The people of the State of Michigan enact*,—That no person shall mix, colour, stain, or powder, or permit any other person to mix, colour, stain, or powder any article of food with any ingredient or material so as to render the article injurious to health, with the intent that the same may be sold; and no person shall knowingly sell or offer for sale any such article so mixed, coloured, stained, or powdered.

Sec. 2. No person shall, except for the purpose of compounding in the necessary preparation of medicines, mix, colour, stain, or powder, or order, or permit any other person to mix, colour, stain, or powder any drug or medicine with any ingredient or materials so as to affect injuriously the quality or potency of such drug or medicine, with intent to sell the same, or shall sell or offer for sale any such drug or medicine so mixed, coloured, stained, or powdered.

Sec. 3. No person shall mix, colour, stain or powder any article of food, drink, or medicine, with any other ingredient or material, whether injurious to health or not, for the purpose of gain or profit, or sell or offer the same for sale, or order or permit any other person to sell or offer for sale any article so mixed, coloured, stained, and powdered, unless the same be so manufactured, used, or sold, or offered for sale under its true and appropriate name, and notice that the same is mixed or impure is marked, printed, or stamped upon each package, roll, parcel, or vessel containing the same, so as to be and remain at all times readily visible, or unless the person purchasing the same is fully informed by the seller of the true name and ingredients (if other than such as are known by the common name thereof) of such article of food, drink, or medicine at the time of making sale thereof or offering to sell the same.

SEC. 4. No person shall mix any glucose or grape sugar with syrup, honey, or sugar intended for human food, or any oleomargarine, suine, beef fat, lard, or any other foreign substance, with any butter or cheese intended for human food, or shall mix or mingle any glucose or grape sugar, or oleomargarine with any article of food, without distinctly marking, stamping, or labelling the article, or the package containing the same, with the true and appropriate name of such article, and the percentage in which glucose or grape sugar, oleomargine or suine, enter into its composition; nor shall any person sell, or offer for sale, or order, or permit to be sold, or offered for sale, any such food into the composition of which glucose or grape sugar, or oleomargarine or suine has entered, without at the same time informing the buyer of the fact, and the proportions in which such glucose or grape sugar, oleomargarine or suine has entered into its composition.

SEC. 5. Any person convicted of violating any provision of any of the foregoing sections of this Act shall be fined not more than fifty dollars, or imprisoned in the county jail not exceeding three months.

SEC. 6. It is hereby made the duty of the prosecuting attorneys of this State to appear for the people, and to attend to the prosecution of all complaints under this Act in all the courts in their respective counties.

SEC. 7. All Acts and parts of Acts inconsistent with the provisions of this Act are hereby repealed.

Approved June 10, 1881.

In reference to this law the *Sanitary Engineer* says:—Michigan has been so progressive in sanitary legislation that it is a matter for regret that the Food Adulteration Bill, endorsed by the National Board of Trade, and which was made a law in this State, was not substituted for the one that has been passed. Unlike the law of this State and New Jersey, it gives no definition of adulteration, and provides no means or machinery for the enforcement of the law. No competent body is entrusted with the duty of determining standards of purity, or what article may be properly exempted from the provisions of the law, and under what conditions. We think time will prove it to be unwise to mention in the Act certain articles, as has been done, for such a law should be general, leaving details to be settled by the State Board of Health, which they can do more intelligently than a legislative committee. We fear the only attempts to prosecute under such a law will be made at the instigation of rival business interests, which are more anxious to persecute and drive out competition than to protect the public health. We hope at its next session the legislature of Michigan will pass the same Act this State has done, as a substitute for the imperfect one now on their statute books.

OIL ADULTERATION.

THE manager of the Marseilles public laboratory gives the following methods for detecting adulteration in olive with other oils:—Beet root oil contains sulphur, and saponifying the oil with an alcoholic solution of caustic potash will bring out the sulphurous acid. Sesame oil can be found by adding a little muriatic acid to a small piece of sugar, and shaking these along with some of the oil—the sesame oil will be recognized by its red colour. Cottonseed oil has to be treated with nitric acid, and on shaking a coffee-brown colour will be seen.

ADULTERATION OF BUTTER WITH TALC.

In a German technological publication—*Dingler's Polytechnische Journal*—it is positively and circumstantially stated that in America butter is adulterated with powdered talc. We have some difficulty in believing this, though such adulteration is just possible, seeing that talc is one of those magnesian minerals which are unctuous or greasy to the touch, like soapstone. If such adulteration is perpetrated, it may be easily detected, by simply melting some of the suspected butter in any glass vessel—a common phial will do, or a lactometer-tube, or a test-tube. If any of this mineral or soapstone, or any other mineral adulterant, is there, it will settle down to the bottom if time is allowed. In order to thus give it time, the phial or tube should be immersed in hot water, and the heat of the water maintained for an hour or two. The application of this simple test by the trade buyers of American butter will do far more to put an end to such adulteration, if it exists, than any spasmodic persecution of small shopkeepers. In all such cases the perpetrators of the adulteration should be punished, not the victims who unknowingly buy it.

ANALYSTS' REPORTS.

At the Berkshire Quarter Sessions the County Analyst reported that 14 samples of food had been submitted to him for analysis during the quarter; four were not genuine. There were nine samples of butter, none of them containing foreign fat—one sample contained 20 per cent. of water; one 19 per cent. of water and 8 per cent. of salt; one 20 per cent. of water, 6 of salt, and 4½ of curd. Two samples of mustard, one of white pepper, and one of arrowroot were genuine. One sample of coffee contained three parts coffee and one part chicory.

At the Cheshire Quarter Sessions, on Monday, the County Analyst (Mr. J. Carter Bell) reported that amongst the samples sent to him for analysis during the past quarter were three of bread, two of pepper, five of mustard, three of tea, four of coffee, two of drugs, two of butter, two of oatmeal, two of flour, three of lard, nine of jam, one sago, one arrowroot; and he did not find that any of these were adulterated.

DEATH OF HENRY JOHN YELD, M.D.

We have the painful duty of recording the death of Dr. H. J. Yeld, the medical officer of health for Sunderland borough and port, on the morning of the 18th November last. Dr. Yeld was one of the most highly esteemed officers in the public health branch of the public service, and he had secured the complete confidence and respect of the corporation and community whom he served in his capacity of health officer. Before his appointment as medical officer of health in 1873, he had held the position of surgeon to the Sunderland Infirmary. He effected suicide by cutting his throat, and the circumstances attending his death have produced the most painful effect in the borough and neighbourhood, where he was so widely known and highly respected. Nothing had been observed to cause any suspicion of the mental change which led to so disastrous a result. Dr. Yeld was an M.D. of St. Andrews, 1862; M.R.C.S. Eng. and L.A.S., 1860; L.M. Glasgow, 1859; and he was educated professionally at Glasgow. He was a Member of the Society of Public Analysts, Fellow of the Chemical and Meteorological Societies, Vice-President of the Northern Counties Association of Medical Officers of Health, and held, besides, the posts of medical officer for the borough and port of Sunderland, public analyst for the borough, physician to the Corporation Hospital, and medical officer to the Life Brigade. "Suicide while in a temporary state of insanity" was the verdict returned by a coroner's jury. Dr. Yeld has left a widow and four children.

THE ANALYSES OF THE PUBLIC WATER SUPPLIES OF ENGLAND.

In compliance with the desire of a large number of those members who are co-operating in this matter, the Council have decided to continue the publication of the analyses for another twelve months, and any Analysts who require further forms of report will receive a supply on sending a post card to that effect to the Secretaries.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1881. All results are expressed in GRAINS PER GALLON.

Description of Sample.	Date when drawn.	Appearance in Two-foot Tube.	Smell when heated to 100° Fahr.	Chlorine in Chlorides.	Phosphoric Acid in Phosphates.	Nitrogen in Nitrates.	Ammonia.	Albuminoid Ammonia.	Oxygen, Absorbed in		Hardness, Clark's Scale, in degrees.		Total Solid Matter, dried at 220° Fahr.	Microscopical Examination of Deposit.	ANALYSTS.
									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Kent Co.	Nov. 22	c. grnsh. yellow	none	1·84	none	·476	·0022	·0032	none	.0040	21·0°	7·0°	34 30	vegetable debris	Wigner & Harland.
New River	„ 15	clear	none	1·09	trace	·210	·0007	·0021	·0140	·0280	15·5°	3·0°	21·84	satisfactory	B. Dyer.
East London ..	„ 16	s. turb. br. grn.	slight	1·91	none	·421	·0032	·0066	·0240	·0580	16·1°	6·1°	25·60	vegetable debris	Wigner & Harland.
Southwark & Vauxhall ..	„ 8	c. f. yellow	none	1·24	trace	·170	none	·0077	·0504	·0728	14·0°	3·5°	19·88	satisfactory	J. Muter.
West Middlesex	„ 5	greenish yellow	none	1·15	trace	·136	·0011	·0055	·0460	·0980	13·8°	2·8°	20·33	satisfactory	O. Hehner.
Grand Junction	„ 14	p. straw colour		1·08	trace	·168	none	·0065	·0237	·0964	15·0°	4·2°	21·50	satisfactory	A. Wynter-Blyth.
Lambeth	„ 8	c. f. yellow	none	1·24	trace	·170	none	·0070	·0448	·0560	14·0°	3·5°	19·60	satisfactory	J. Muter.
Chelsea	„ 15	c. grnsh. yellow	none	1·26	trace	·140	none	·0080	·0500	·0810	16·0°	4·5°	22·40	none	A. Dupré.
Bath	Nov. 18	clear f. blue	none	·91	none	·150	none	·0002	none	none	17·0°	4·5°	22·80	diatoms carb. lime	J. W. Gatehouse.
Bradford	„ 16	s. opq. pty. yell.	none	·60	none	none	none	·0049	·0530	·1400	3·6°	3·4°	7·90	none	F. M. Rimmington.
Birmingham ..	„ 7	grnsh. and turb.	none	1·40	traces	·185	·0028		·0390	·1070	10·9°	6·2°	19·46	vegetable forms	A. Hill.
Bolton	„ 12	v. turbid yellow	none	·45	none	·038	·0019	·0061	·0268	·0426	3·2°	3·0°	7·12	mineral and veg. matter	W. H. Watson.
Brighton	„ 11	c. green blue	none	1·98	traces	·472	0019	·0020	none	·0060	13·2°	4·4°	22·00	vegetable debris	Wigner & Harland.
Bristol	„ 7	p. brnsh. green	none	·85	none	·129	·0001	·0029	·0196	·0564	14·5°	1·7°	18·40	v. slight sand	F. W. Stoddart.
Bury (Lan.) ..	„ 14	s. turbid yellow	s. mossy	·84	none	·048	·0043	·0086	·0200	·0333	4·5°	4·4°	7·88	mineral and veg. matter	W. H. Watson.
Cambridge	„ 16	c. pale blue	none	1·33	traces	·461	·0005	·0015	none	·0140	17·5°	5·5°	24·00	satisfactory	J. West Knights.
Canterbury	„ 18	c. pale blue	none	1·47	none	·336	·0005	·0006	·0040	·0060	8·6°	4·3°	11·76	s. carb. lime	S. Harvey.
Croydon	„ 17	c. b. colourless	none	1·26	traces	·268	none	·0030	·0066	·0066	16·5°	7·0°	22·60	none	C. Heisch.
Darlington	„ 14	v. yellow green	peaty	·70	trace	·034	·0007	·0028	·1726	·2613	6·5°	4·5°	8·40	satisfactory	W. F. K. Stock.
Edinburgh	„ 18	s. brown	none	·67	none	traces	·0024	·0064	·0160		4·2°	3·9°	5·84	none	J. Falconer King.
Exeter	„ 10	f. brnsh. yellow	none	·84	trace	·219	·0018	·0031		·0756	2·8°	2·8°	6·30		F. P. Perkins.
Grantham	„ 5	c. greenish	none	1·05	trace	·530	·0016	·0027	·0156	·0235	14·6°	4·5°	23·57	diatoms and veg. debris	A. Ashby.
Hastings	„ 15	clear blue	none	4·70	trace	·020	none	·0035	·0020	·0084	10·5°	7·5°	26·40	none	H. F. Cheshire
Ipswich	„ 14	colourless	none	2·24	trace	·207	·0049	·0025	none	·0080	19·0°	8·5°	30·12	satisfactory	J. Napier.
King's Lynn ..	„ 2	drty. mlky. whte.	faint	1·59	traces	·322	·0022	·0084	·0232	·4372	17·5°	5·0°	21·98	mov. orgns. dec. veg. mtr.	W. Johnstone.
Leicester	„ 19	v. s. yellow	none	1·30	traces	·078	·0015	·0037	·0146	·0755	7·7°	5·3°	14·30	satisfactory	W. L. Emmerson.
Liverpool	„ 16	yellow brown	s. peaty	1·08	traces	·052	·0028	·0082	·0358	·0728	4·8°	3·7°	8·54		A. Smetham.

SOCIETY OF PUBLIC ANALYSTS.

Analyses of English Public Water Supplies in November, 1881. All results are expressed in GRAINS PER GALLON.

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									15 mins. at 80° Fahr.	4 hours at 80° Fahr.	Before Boiling.	After Boiling.			
Maidstone—															
Wtr. Company	Nov. 11	green	none	2·93	trace	·576	none	·0023	·0145	·0182	18·0°	5·8°	35·42	none	M. A. Adams.
Public Conduit	,, 11	v. light blue	none	2·33	trace	·576	none	·0008	0036	·0075	17·1°	5·8°	31·57	none	M. A. Adams.
Manchester....	,, 16	c. f. yellowish	none	·74	none	none	·0030	·0051	·0228	·0915	2·0°	1·8°	4·22	s. mineral	W. Thomson.
Newark	,, 11	c. blsh green	none	1·42	trace	·040	·0017	·0043	·0247	·0463	18·0°	14·0°	37·63	satisfactory	A. Ashby.
Newcastle-on-Tyne......	,, 8	f. yellow	none	·81	trace	·040	·0010	·0090	·0710	·1130	16·8°	6·5°	20·00	satisfactory	J. Pattinson.
Norwich	,, 9	p. grnsh. yellow	none	1·85	trace	·048	traces	·0088	·0340	·0826	12·2°	3·7°	15·60	satisfactory	W. G. Crook.
Nottingham ..	,, 15	grnsh. blue	slight	2·20	none	1·930	none	·0039	none	·0060	17·0°	10·6°	34·20	vegetable debris	Wigner & Harland
Portsmouth ..	,, 14	s. turbid	none	1·12	trace	·230	trace	·0050	none	none	16·6°	2·0°	18·50	dec. veg. debris, diatoms	W. J. Sykes.
Reading	,, 10	c. f. greenish	none	·85	none	·075	·0005	·0042	none	·0350	13 0°	3 8°	17·50	satisfactory	J. Shea.
Rochdale	,, 19	pale blue	none	·60	none	·030	0014	·0014	·0140	·0420	2·5°	2 5°	5·00	satisfactory	T. A. Collinge.
Rugby	,, 4	f. turbid	none	1·28	h. traces	·152	·0042	·0119	·0175	·0308	10·7°	8 6°	16 80	veg. deb., diats., bacteria	A. P. Smith.
Salford	,, 1	c. bright yellow	none	·70	none	none	·0014	·0350	·0028	·0420	3 0°	2·5°	5·00	none	J. Carter Bell.
Sevenoaks	,, 15	clear	none	1·40	trace	·341	·0007	·0042	trace	·0110	12 0°	3·0°	18·48	satisfactory	B. Dyer
Swansea	,, 16	clear	none	·80	trace	none	·0010	·0056	·0040	·0040	1·5°	1·5°	3·78	none	W. Morgan.
Southampton ..	,, 18	grnsh. yellow	none	1·00	h. trace	·470	trace	·0044	·0220	·0800	12·5°	4·5°	19·60	satisfactory	A. Angell.
Shrewsbury ..	,, 7	c. colourless	none	1·45	none	·280	·0015	·0055	0040	·0040	22 0°	6 0°	24·00	none	T. P. Blunt.
Warwick	,, 16	greenish	none	1·33	none	·126	·0007	·0049	·0240	·0540	19 2°	13 0°	23·10	none	A. Bostock Hill.
Whitehaven ..	,, 3	c. f. green	none	·35	none	·007	none	·0010	·0069	·0170	·4°	·4°	1·96	satisfactory	A. Kitchin.
Wolverhampton	,, 14	s. yellow brown	none	1 33	trace	·126	none	·0049	·0392	·0314	13·7°	6·7°	21·56	veg. spores & deb., diats.	E. W. T. Jones.
Philadelphia U S.A.—															
Schuylkill Wtr.	Septr.			·65	none	·0430	none	·0056					12·60		H. Leffmann.
Delaware Wtr.	,,			1·31	traces		·0018	·0140					11·60		H. Leffmann.

Abbreviations:—c., clear; f., faint; h., heavy; p., pale; v. h., very heavy; v.-s., very slight.

THE PUBLIC WATER SUPPLIES OF ENGLAND.

VALUATION, ACCORDING TO "WIGNER'S VALUATION SCALE," OF THE ANALYSES PUBLISHED THIS MONTH.

In the following table we give the *average* valuation of those public water supplies reported on this month from January to June, and the valuation of the July, August, September, October, and November waters.

		Average to June	July.	August	Sept	October	November
LONDON	Kent	30	27	20	27	29	26
	New River	26	17	17	21	24	25
	East London	32	39	20	28	35	46
	Southwark and Vauxhall	34	28	31	27	30	43
	West Middlesex	30	24	29	39	33	43
	Grand Junction	30	23	25	30	31	36
	Lambeth	37	29	31	26	33	37
	Chelsea	30	26	32	36	37	43
	Bath	12	19	20	..	13	16
	Birmingham	33	57	26	29	36	47
	Bolton	..	17	19	17	29	29
	Bradford	53	53	59	44	36	31
	Brighton	24	23	25	21	22	25
	Bristol	22	27	..	30	29	24
	Bury	..	35	24	24	30	33
	Cambridge	28	26	22	21	22	22
	Canterbury	17	22	16	12	15	13
	Carlisle	27	30	..	..	22	21
	Darlington	33	39	96	50	74	62
	Derby	18	13	..	..	..	..
	Dublin	23	..	13	..	..	..
	Edinburgh	28	21	20	24	31	25
	Exeter	20	16	23	23	18	23
	Grantham	27	..	32	..	70	30
	Hastings	..	20	25	..	27	25
	Huddersfield	23	26	28	..	..	..
	Ipswich	27	30	30	..	25	25
	King's Lynn	94	110	48	110	84	128
	Leamington	26	..	26	..	24	..
	Leeds	35	28	22	..	..	..
	Leicester	42	24	26	23	25	27
	Liverpool	86	29	41	47	37	31
	Maidstone—Water Company	39	34	30	31	38	35
	„ Public Conduit	36	28	25	27	31	27
	Manchester	22	17	29	28	49	27
	Newark	39	46	41	..	33	34
	Newcastle-on-Tyne	37	40	43	68	57	55
	Norwich	36	49	36	33	34	38
	Nottingham	39	46	38	42	62	55
	Plymouth	29	..	..	28	..	..
	Portsmouth	30	22	26	27	24	29
	Reading	25	20	34	23	25	18
	Rochdale	9	7	9	..	5	12
	Rugby	41	..	..	46	69	55
	Salford	18	14	21	21	15	14
	Sevenoaks	20	..	..	..	..	20
	Shrewsbury	23	..	17	19	21	25
	Southampton	43	..	40	40	40	57
	Sunderland	25	27	..	..	..	..
	Swansea	16	14	19	15	12	12
	Tunbridge Wells	..	..	..	35	..	..
	Warwick	34	34	..	40	..	40
	Whitehaven	9	17	14	10	10	7
	Wolverhampton	46	39	32	15	33	41

Owing to considerations of space we have omitted from this table those places as to which we have published no analyses during the past four months.

In the case of the Metropolitan waters, the average valuation of the supplies for November show an increase of 6 over the valuation for October, but the increase is almost entirely in the supplies of the companies drawing from the rivers Thames and Lea. The Kent water shows a slight though not notable improvement, the New River water an increase in the valuation of only one, while the other companies have increases ranging from 4 in

Lambeth to 18 in Southwark and Vauxhall. These waters, however, cannot even with this increased valuation be considered as really second class.

Among the provincial supplies reported on this month the most pure are Whitehaven with a valuation of 7, Rochdale and Swansea 12 each, Canterbury 13, Salford 14, Bath 16, Reading 18, and Sevenoaks 20.

These results show scarcely any notable changes from last month's—in fact these pure supplies have not yet appeared to have that slight amount of winter contamination which we presume is to be expected in them as well as in the slightly less pure waters.

Following these best waters we have Croydon with a valuation of 21, Cambridge 22, Exeter 23, Brighton, Hastings, Ipswich, and Shrewsbury 25 each, Leicester, Maidstone Public Conduit, and Manchester 27 each, Edinburgh 28, Bolton and Portsmouth 29 each, and Grantham 30. The only changes of note in these figures are considerable improvement in the Manchester and Grantham supplies, which in both cases is almost entirely due to a large reduction in the amount of oxygen absorbed.

The valuations of Bradford, Darlington, Liverpool, Maidstone Water Company, Newcastle, Nottingham, Rugby, Southampton, show an improvement over the valuations of last month, while on the other hand the analyses of the waters of Birmingham, Bury, King's Lynn, Newark, Norwich, Portsmouth, and Wolverhampton give less satisfactory indications. The usual winter deterioration does not, however, appear to be on the whole quite as marked this month.

INTERNATIONAL FOOD EXHIBITION, 1881.

The following is the Report made by the Judges--H. C. Bartlett, Ph.D., F.C.S.; G. W. Wigner, F.C.S., F.I.C.; J. Milner Fothergill, M.D.; J. Danford Thomas, M.D.; at the Food Exhibition held at the Agricultural Hall during the first fortnight in November:—

The exhibits of this year show in many respects a great improvement over those of last year. There is little increase in the variety of food staples shown, but in most cases greater attention appears to have been paid to the purity and quality of the goods exhibited.

Tinned foods necessarily occupy a very important place in the Exhibition. The display of them this year is as prominent as heretofore. We have carefully tested these goods for quality, and are of opinion that every care is being taken to maintain the highest known standards, as well as to bring out novelties of superior quality. There are certain difficulties supposed to be inseparable from the process of canning meat, fruits, and vegetables; but noteworthy improvements have been made by the packing companies.

Several new inventions have been submitted to us which show that those who are most familiar with the subject are giving their attention to this matter, and, although we cannot say that the difficulties in question have been altogether overcome, yet there has been a marked advance since last year. Tinned goods must come more and more into use; and for this reason it becomes essential to watch closely the character of the articles which are being sent to this country.

We are more dependent than ever on the United States and Canada for cereals, and the exhibits on this occasion are of a high class. There are nearly twenty different preparations of maize, all of which are easily rendered available for the table, while several other cereals are suitably prepared; but some would be improved by the separation of the husk before being packed.

The English preserved meats, jams, &c., that are shown are of the highest quality that have ever been presented to our notice. It would be invidious to draw special attention to any one exhibit, except so far as has been done by the awards given.

It is extremely satisfactory to find that pickles and jams, perfectly genuine, and of the highest quality, are offered for sale at prices which are comparable with those ordinarily paid.

As regards the ærated waters and other "temperance" drinks, we have analysed every beverage exhibited, and they are all non-alcoholic. The flavour of these "temperance" beverages shows, in many instances, a very marked improvement; and in most cases there is no excess of medicinal constituents, the flavour being now due to fruit extracts instead of to objectionable artificial essences.

Genuine cocoas and chocolates are more conspicuous than before. We note with satisfaction the increased use of pure cocoa.

There are valuable exhibits of Australian and other colonial wines, which are of importance as showing what our colonies can do in this class of produce.

Tea is well represented, and we can speak with satisfaction of the samples shown.

The exhibits of cooking stoves are not as numerous as might have been expected, but we are favourably impressed with the character of those shown, and especially of some gas stoves.

The dough and kneading machinery exhibited is well designed.

All the Foods specially put forward for infants fall short in those soluble nutritive matters which are essential. These foods are all too starchy.

The Silver and Bronze Medals and the Certificates of Honourable Mention have been awarded as much for the general character of the exhibits, as for their purity or excellence in their respective classes.

Some exhibits would have received higher awards had their importance equalled the peculiar merits of the articles shown.

The following extract from the list of awards may be of interest to our readers:—

SILVER MEDALS.

Davis, H. & C., & Co., 200, Camberwell Road, S.E., for Gas Cooking Apparatus.

Challen, D., 121, Mildmay Road, N., for Vanilla, Flavouring Essences, and Wilson's American Biscuits.

Anglo-Swiss Condensed Milk Co., 10, Mark Lane, for Condensed Milk.

Dunn & Hewett, Pentonville Road, for Rock Cocoa and Manufactured Chocolate.

Thurber, H. K. & F. B., 9 and 11, Fenchurch Avenue, E. C., for Cereal Products.

Thurber, H. K. & F. B., for Canned Meats.

Evans, Sons & Co., Hanover Street, Liverpool, for Lime Fruit Preparations and Lime Juice Sauce.

Vin-Santó Co , for Orange and Tonic Champagne and Vin-Santó.

Aylesbury Dairy Co., St. Petersburgh Place, Bayswater, W., for Peptonised Milk and Koumiss.

Tulloch, W., & Son, 26 and 27, Bury Street, St. Mary Axe, E.C., for Pure Dutch Cocoa.

Zoedone Company, Wrexham, for Zoedone, dry and sans sucre.

Burgess, J., & Sons, 107, Strand, for Preserved Anchovies, Sauces, and Pickles.

Beach, T. W., Old Brentford, for Genuine Jams.

Maignen, P. A., 22 and 23, Great Tower Street, E.C., for Improved Application of the "Filtre Rapide."

BRONZE MEDALS.

Brand & Co., 11, Little Stanhope Street, W., for Albuminous and other Concentrated Extracts of Meat.

Chemists' Aerated and Mineral Water Association, Limited, 45, Gifford Street, N., for B. P. Aerated Waters.

Begg, J. & Co., Manchester Road, Bolton, for Chili Moselle, Ginger Ale, and Lemonade.

Bellis, T. K., Jeffrey's Square, E.C., for Sun-dried Turtle and Turtle Soup.

Skinner, G. H., 13, North Street, Exeter, for Quinine Sparkling Tonic, and Orange Champagne.

Delacre's Extract of Beef Company, 48, King William Street, E.C., for Extract of Beef.

Savory & Moore, 143, New Bond Street, W., for Pharmaceutical Preparations.

Lehmann & Co , 106, Fenchurch Street, E.C., for "Aventicum" Condensed Milk,

HONOURABLE MENTION.

Noble & Co., 3, Savage Gardens, Tower Hill, E.C. for Bjorkbom's Malt Extract (simplex.)

Chollett & Co., 134, Fenchurch Street, E.C., for Dried and Compressed Vegetables for Soups.

Feltoe & Sons, 27, Albemarle Street, W., for "Specialité" Lime Juice.

Goundry & Co., 181, Upper Thames Street, E.C., for Consolidated Tea.

Gulliver, S., & Co., Vale of Aylesbury, for Whiskey Curaçoa and Aerated Waters.

SPONTANEOUS COMBUSTION BY NITRIC ACID.

In consequence of the burning of a car during the fall of 1879 on one of the railways in Baden, which was suspected to have been caused by nitric acid, Professor R. Haas, of Carlsruhe, was called upon by the government to report whether that acid could produce combustion or not. In the experiments made to solve this question, the conditions which might be supposed to exist in freight cars containing nitric acid were imitated as far as possible. Small boxes of a capacity of ten to sixteen quarts were charged with variable proportions of hay, straw, tow, and blotting-paper—all of which substances are used in packing- and placed within larger boxes, while the space between them was filled with hay or tow, to prevent too rapid a radiation of heat, because the experiments were to be conducted in the open air, and the outer box at the same time represented the walls of a railway car. The material contained in the inner box was now saturated with acid, and rather tightly compressed, so that when the cover was put on it was pretty well filled. At first reddish and afterwards whitish vapours were given off, finally a distinct smoke. On lifting the cover strongly glowing patches could be seen, which rapidly increased all through the contents, and which broke out in bright flames on access of free air or gentle fanning. With red fuming acid, or with acid of specific gravity 1·48, these results were obtained very rapidly and within a few minutes. With ordinary acid, of specific gravity 1·895, it required somewhat more time, and the action was less energetic in the beginning; but, in three different trials, after about twenty minutes, the same result was finally obtained, provided the material was packed tightly in the box, and was thoroughly saturated in its successive layers.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

PHOSPHORIC ACID DETERMINATIONS.

To the Editor of "The Analyst."

Sir,—May I be permitted to draw attention to a little matter connected with the Instructions for Water Analysis compiled by the Water Committee of the Society of Public Analysts.

In determining the phosphoric acid qualitatively, they direct that strong nitric acid is to be added to the residue in the platinum basin, and then evaporated to dryness, &c. Now I have observed that if this is done a little platinum is dissolved whenever there is a notable quantity of chlorides in the residue. This is undesirable for two reasons. Firstly,—because our platinum basins will gradually become vanishing quantities, in fact I have noticed that mine have lost weight more rapidly since I have pursued this plan; and secondly, because the platinic chloride formed imparts a yellow tinge to the solution before the molybdic solution is added, and therefore a trace of phosphoric acid may be assumed to be present whether it is there or not. Although this would not be of much consequence with some waters—as for instance with those derived from Oolitic formations, which I believe always contain a faint trace of it, yet in others it would interfere with scientific accuracy.

In order to avoid this possible source of fallacy, I would suggest that after the strong nitric acid has been added to the residue in the platinum basin, it should always be transferred to a porcelain one before it is evaporated to dryness. There would be no chance of missing any trace of phosphoric acid, as phosphates are so readily soluble in the acid.

I am, Sir,
Your obedient Servant,
ALFRED ASHBY.

Grantham, Nov. 17th, 1881.

ESTIMATION OF TANNIN IN TEA.

To the Editor of "The Analyst."

Sir,—Since the publication of my paper in June last on the Estimation of Tannin in Tea, I have made further examinations of a similar kind on thirty other samples of tea, the results of which are appended. They go far to show that there are many exceptions to the rule, if it be one, that Green Teas contain more Tannin than Black Teas.

RESULTS OF TEA ANALYSES.

Description.	Ash Total.	Ash Soluble.	Ash Insoluble.	Tannin.	Extract.
Black Tea	5·67	3·07	2·60	22·75	37·0
"	5·79	3·39	2 40	17·23	31·7
"	6·45	3 05	3·40	23·73	37·5
"	5·84	2·64	3·20	17·23	30·5
"	6·26	3·21	3·05	11·70	30·9
"	5 99	2·99	3·00	11·05	33·8
Green Tea	6·19	3 79	2·40	9 1	38 0
"	7·39	4·29	3·10	7·48	35·0
"	5·99	3·90	2·09	6 18	33·5
"	6·89	3·44	3.45	7·48	33·2
"	6·64	3 09	3·55	7·15	33·5
"	5·94	4·24	1·70	17·55	32·7
Black Tea	6·74	3·14	3·60	17·25	23·4
"	5·86	3·43	2·43	18·85	30·2
"	6·38	3·10	3·28	16·58	30·6
"	6·47	3·33	3·14	23·20	35·7
"	5·94	3·44	2·50	27·30	39·6
"	6·06	3·36	2·70	24·70	38·6
Green Tea	6·06	4·16	2·90	23·40	37·6
"	5·84	4·19	1·65	23·11	35·4
"	6·39	4·66	1·73	25·35	38·1
"	6·77	3·17	3 60	22·72	34·2
"	7·06	3·61	3·45	19·18	30·7
"	6·21	3·86	2·35	20·15	31·6
Black Tea	6·31	3·54	2·77	27·61	39·0
"	6·05	3·42	2·63	19·17	31·6
"	6·48	3·80	2·68	26·07	38·8
"	6·80	3·79	3·01	21·70	35·8
"	5·93	3·24	2·69	21·41	33·2
"	6·18	3·40	2,78	27·31	40·1
Averages.. ..	6·28	3·52	2·76	18·92	34·2

In reference to the actual titration by permanganate, which may be carried out either in a beaker or in a porcelain dish, I wish to state that after considerable experience I have come to the conclusion that the dish is preferable, as the faint rose tint indicative of the excess of permanganate, which shows on the white background at the edge of the liquid, admits of more ready detection than does the clear yellow colour of the whole volume of liquid in the beaker.

It may be mentioned in regard to this excellent process that the improvement in Löwenthal's original method is largely based on the suggestion of Mr. C. Estcourt, in a paper contributed to the *Chem. News*, Vol. XXIX., p. 109, to precipitate the tannin with gelatine, and to titrate the solution with potassium permanganate both before and after such precipitation, using indigo as indicator.

I remain,
Yours faithfully,
ALFRED HILL, M.D., F.I.C.

PUBLIC ANALYSTS' APPOINTMENTS.

To the Editor of "The Analyst."

Sir,—On my appointment as Public Analyst to the City of Worcester, the terms of agreement included the analysis of water forwarded to me by certain city officials. This autumn I was requested by the city surveyor to analyse four samples of sewage effluents taken from the county of Gloucester. Not considering a sewage effluent to be water, nor Gloucestershire to be included in the city of Worcester, I sent in an account of extra fees. The Town Council decided that sewage and effluents were water, and that the locality they came from made no difference, so that I was obliged to agree to their analyses as part of my ordinary duties. I thought it well to send you this information that other analysts may take care that the terms of their appointments do not bring upon them heavy extra duties without pay.

Yours faithfully,
HORACE SWETE, M.D.,
Analyst City of Worcester, &c.

45, Foregate Street, Worcester, Nov. 25th, 1881.

Extract from Terms of Appointment.

"2.—The 40 Analyses above-mentioned shall include the analysis, once in every three months, of the Water supplied from the City Water-works, and also, once in every three months, of the Gas supplied from the Worcester Gas-works; but the Analyst shall not be required to make any analysis of the Gas until the Council of the said City shall think fit to provide the requisite apparatus. The said 40 Analyses shall also include such Articles of Food and Drugs and such Water as shall be submitted to the Analyst by the Medical Officer of Health, the Inspector of Nuisances, or the Inspector of Weights and Measures of the said City, or by any other person authorised by the Council or the General Health Committee. Every Analysis after the first 40 so submitted shall be paid for at the rates above-mentioned."

A NEW MANUFACTURE—WATERED LARD.

The following letter appeared in *The Times* recently:—

To the Editor of "The Times."

Sir,—I have this day received the notice below as a fly-leaf to a trade circular. It is well the public should have their attention called to it, so that they may be on their guard as to what they really are purchasing.

Yours faithfully,
FAIR-DEALING.

November 18th, 1881.

"Watered lard being now used extensively, owing to the high price of the pure quality, we are giving our special attention to its manufacture, and shall be pleased to send samples and prices if you are buyers."

[In our law reports will be found a case in which a shopkeeper was convicted for selling this watered lard.—Ed. Analyst.]

LAW REPORTS.

Convictions for Refusing to Serve Inspector:—

Edward Burgess, milk dealer, Ford Street, Salford, was summoned under the 17th section of the Sale of Food and Drugs Act, for refusing to supply a sample of milk to the inspector when he demanded it. Mr. Walker appeared in support of the summons, and said that this was one of the first prosecutions under the above section, and the offence was undoubtedly a serious one. If he proved the case he should ask the Magistrate to inflict a substantial penalty, in order to strengthen the hands of the inspector. The defence was that the defendant did not sell the milk to the inspector as he did not know what the quality of the milk was which the inspector asked for; but by this time everybody must know that the health department did not wish to act arbitrarily, and that they were willing to assist the milk dealers by taking samples from the people who supplied them with milk. Mr. Gardner defended. Charles Edward Thompson, inspector under the Sale of Food and Drugs Act, said at about half-past ten o'clock on the 13th September he was in the shop of John Henry Stubbs, Ordsal Lane, when the defendant stopped his cart at the door and entered the shop. He asked Mrs. Stubbs how much milk she required, and she said a quart. He got some milk from a can which he had in his cart, and handed it to Mrs. Stubbs. Witness then told the defendant that he required a pint of milk from the can from which he had taken the milk for Mrs. Stubbs, and tendered the price of the milk. Defendant said, "I cannot sell you this, Mr. Thompson, I do not know what it is; I purchased it at the station, and I would not like to sell you it." Witness said that did not matter to him, and told the defendant that he had taken a sample of milk from Mrs. Stubbs, which was not pure, and consequently he had waited for the defendant. Defendant again said he could not let the officer have the milk. Witness did not get the milk, and he and the defendant left the shop together. Witness said, "I suppose you know the consequences of refusing to let me have the milk?" Defendant said, "Yes I know there is a penalty but really I would rather be fined for not selling it to you than I would be fined for selling you something when I did not know whether it was right or not." In cross-examination, the witness said the defendant said he would let him have the milk if he would label it "milk-and-water." He replied that he could not do so, as he had demanded milk. Defendant said he had some of his own farmer's milk, and he would let him have some of that. Witness had taken a score of samples from the defendant before, all of which were right. The defence was that the defendant did not sell the milk to the officer, as he had purchased it at the station, and did not know what the quality of it was, and he candidly told the officer this. The Magistrate said if this had been the sort of case he thought it was at first he should have fined the defendant £5 or £10; but as the officer had previously taken a score of samples from the defendant, which had turned out to be right he should not impose a high penalty. He must, however, show by the fine which he would inflict, that it was a very serious offence when a person refused to sell the inspector a sample of milk from any can out of which he might require it. Defendant was fined 40s. and costs.

George Nicholson, milk dealer, 23, Roland Street, Salford, was summoned for a similar offence. Mr. Walker appeared in support of the summons, and Mr. J. A. Horner (Messrs. Horner & Sons) defended. Inspector Thompson said on the 9th inst. he was on duty in Turnerson Street. He saw the defendant, who was calling out, "Now, ladies, pure, new milk." Witness saw the defendant, who had a horse and cart, sell a pint of milk to a woman named O'Connor. Witness said, "Give me a pint of that pure, new milk, George." He looked round, and then said, "I have none." Witness then demanded the milk, and offered the defendant twopence for it. Defendant said, "I tell you I have none, and that is good enough for you." Defendant began to drive away, whereupon witness told him that if he did not supply him with the milk he should summons him. Defendant said, "You can do what the —— you like," and then drove off. Elizabeth O'Connor gave corroborative evidence. The defence was that the defendant had no milk left when the inspector asked for some. The Magistrate said this was a bad case, and imposed a fine of £5 and costs.

Milk Adulteration:—

At Lambeth, Robert Kent, dairyman, of George Street, Vauxhall, appeared to a summons taken out by Inspector Bott, for the Lambeth Vestry, for selling milk in an adulterated condition. Milk was purchased at the defendant's shop, and upon being tested by Dr. Muter was found to have been adulterated to the extent of 37 per cent. with added water. The defendant had been previously convicted of a similar offence, and fined £3. Mr. Chance said it was a very bad case, and ordered the defendant to pay £5 and 12s. 6d. costs.

William Hedges, dairyman, of 100, Tyer Street, Vauxhall, was summoned also by Inspector Bott for a similar offence. The adulteration in this instance amounted to 18 per cent. of added water, and Mr. Chance imposed a penalty of £2 and 12s. 6d. costs.

At Ramsgate, David Morrison pleaded not guilty to selling milk to the prejudice of the purchaser, not of the nature, quality, or substance demanded, on the 9th August.—Mr. May, in proving the case, said he purchased the milk of defendant on the Sands, and paid him 2½d. for it. The certificate from the analyst showed the milk to be adulterated to the extent of 8 per cent. with added water, and that it contained boracic acid, which witness believed was put in to keep the milk.—Defendant, who stated to the inspector that he bought the milk of Mr. Smith, in Queen Street, now said that all the water found in it came there through putting ice in it overnight to keep it.—Mr. May said he purchased milk of Mr. Smith the same day, and that was pure.—Defendant, who was convicted last year for a similar offence, was now fined 40s. and 10s. costs, or three weeks' imprisonment. The money was paid.

Butter Adulteration:—

At Hungerford, Mr. Giles, grocer, of Kintbury, appeared on the information of Inspector Whinchcombe, charged with having, on September 23rd, sold for butter a substance which was not butter. Stephen Chapman, an inspector under the Food and Drugs Act, stated that on the day in question he went to the defendant's shop and purchased half a pound of butter from defendant's daughter. He asked for the proprietor, and on Mr. Chapman coming forward he told him that the butter just purchased would be sent to the Public Analyst to be analysed. This the witness had done, and the analyst's report stated that the article in question contained 20 per cent. of water, instead of 10 per cent. as allowed. Defendant said he bought the article for butter from Mr. Allen. It had not since been tampered with, and was in the same state as he bought it, a statement his daughter corroborated. It had been retailed at 1s. 2d. per lb., which was only a fair profit, and his customers had made no complaint. He had received no warranty with it when bought. Mr. Allen deposed to having sold the butter, which he believed to be in the same state as when sold to the defendant. Witness had bought it of Messrs. Symes, of Bristol, and he sold it as delivered to him. He had written to the factors, and had a telegram from them, in which they would not admit any responsibility themselves, but offered to give the name of the party consigning it to them. The Chairman said that while bound to convict, the Bench did not believe there had been any fraudulent intention on the part of the defendant. In order to protect himself in future he must obtain a warranty with his butter when he purchased it. They would only inflict a nominal fine of 10d., which, with 16s. 8d. costs, would make 17s. 6d. for defendant to pay.

"First Cork Butter;" Conviction for Adulteration:—

At Wokingham, on November 3rd, James Jennings, grocer, of Denmark Street, was summoned by Detective-constable Sheppard, inspector under the Food and Drugs Act for the county of Berks, for selling to him, on Sept. 22, a certain article of food, to wit, butter, the same not being of the nature, substance, and quality demanded. Defendant pleaded not guilty, stating that he sold the butter just as he received it. The inspector produced the analysis of the butter received from the County Analyst, showing that it contained 20 per cent. of water, 4½ per cent. of curd, and 6 per cent. of salt. Mr. J. Holmes (Holmes & Co., Reading) said his firm supplied the utter to the defendant. He contended that the analysis did not prove that it was adulterated; in fact, they purchased it as a "first Cork butter," and consigned it straight to their customers. The Bench imposed a fine of 2s. 6d. and 12s. 10d. costs, and Mr. Holmes advised the defendant to appeal against the decision, remarking that his firm would bear the expense. The defendant was further charged with selling adulterated coffee. The inspector bought some coffee, and the defendant handed him the article, a fourth part of which, on analysis, was found to be chicory. For this offence he was fined 2s. 6d. and 9s. 6d. costs.

In connection with the recent letter published in *The Times*, and reprinted on another page, the following case will be of interest:—

Conviction for Selling Watered Lard:—

Mr. John Dodd, grocer, 288, Ordsal-lane, was summoned to the Salford Police Court last week, for selling three-quarters of a pound of lard which contained 17 per cent. of water. Mr. J. C. Walker, assistant town clerk, appeared in support of the summons, and Mr. Edge, barrister, for the defendant. On the 4th inst. Mr. Charles Edward Thompson, inspector for the borough under the Sale of Food Act, visited the defendant's shop, and purchased three-quarters of a pound of lard at 7d. per pound. He paid 5d. for it and told the manager that he had purchased it for analysis. The manager said they did not sell what the witness had purchased as pure lard. In cross-examination, Inspector Thompson said the defendant told him he sold the lard as "watered lard." Mr. J. C. Bell, public analyst, gave evidence to the effect that he had analysed the sample of lard sold by the defendant to the inspector, and found it contained 17 per cent. of water. Pure lard was composed of pure pig's fat. For the defence, Mr. Edge contended that the prosecution had failed to prove that the water had been put into the lard for the purpose of increasing its bulk and to defraud the purchaser. The defendant sold the lard just as he got it from the wholesale dealer. There were three qualities of lard—the pure lard, the seconds quality, and the thirds quality. Now, if shopkeepers were compelled to sell only pure lard they would have to revolutionise their business, and if pure lard was only to be sold, the public would have to pay for it. In this case there was no fraud; the sample sold to the inspector was thirds quality, and he only paid thirds price for it. If shopkeepers were to be harassed by prosecutions of this sort, it would be almost impossible for them to carry on their business. Mr. Makinson said there must be a conviction, because he believed the water had been added for the purpose of increasing the bulk of the lard, but taking into consideration the fact that defendant sold the lard as he got it, the defendant would only be fined 20s. and costs. Mr. Edge applied for a case for a higher court if necessary, and the application was granted.

Mr. J. Falconer King, Analyst to the City of Edinburgh, has been appointed Public Analyst for the County of Selkirk.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1881	Name of Patentee.	Title of Patent.	Price.
774	J. Fife	Electric Lamps	2d.
814	J. M. Bonneville	Treating Nitrous or Nitrous Ether Derivatives of Sugar	2d.
964 965 966	W. Weldon	Manufacture of Chlorine each	4d.
967	Do.	Manufacture of Hydrochloric Acid and Chlorine	4d.
1232	H. E. Upton	Electric Lamps	2d.
1236	J. A. Berly	do.	8d.
1261	H. E. Newton	Manufacture of Sulphocyanides and Ferrocyanides	10d.
1289	P. Jensen	Manufacture of Soap from Animal and Vegetable Fatty Matters	4d.
1291	B. J. Mills	Treating Hominy	4d.
1424	W. G.	Manufacture of Acetate of Soda	4d.
1470	A. M. Clark	Manufacture of Sugar	4d.
1487	E. G. Thomas	Manufacture of Colouring Matters	4d.
1530	J. C. Smith	Manufacture of Cement	6d.
1536	J. L. Dupont-Auberville	Electric Lamps	6d.
1543	St. G. L. Fox	Electric Lamps	6d.
1562	H. H. Lake	Manufacture of Soap	4d.
1547	E. G. Brewer	Manufacture and Refining of Artificial Butter	8d.
1555	J. G. Tongue	Treating Bituminous Substances	6d.
1564	R. Wild	Treating and Purifying Sewage	6d.
1570	R. Pease and T. Lupton	Treating House Refuse and Sewage Matter for Manure	8d.
1587	W. Young	Manufacture of Mineral Oil and Ammonia	1s.
1596	A. W. Reddie	Electric Lamps	6d.
1605	A. M. Clark	Extracting Oxides of Zinc and Copper from Ores	4d.
1670	G. S. Grimston	Electric Lamps	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Chemists' Journal; Oil and Drug News; The Textile Record of America; Sugar Cane; Country Brewers' Gazette; The Medical Record; Oil and Drug Journal; The Canada Lancet.

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